3 1761 08091851 9

Vol. XI JUNE, 1922 - Part I, No. 23 -
NOV. 1922 PART II, No. 24

THE RECORD

American
Institute of Actuaries

525082
19.7.51

PUBLISHED BY THE
AMERICAN INSTITUTE OF ACTUARIES

NOTICE

Article XIV of the Constitution of the American Institute of Actuaries reads as follows: "No resolution expressive of opinion shall be entertained at any meeting."

The publication of any article in "The Record" does not imply a "resolution expressive of opinion" by the Institute, nor does it make the Institute responsible therefor.

Communications to the American Institute of Actuaries should be sent to the Secretary.

RULES OF THE LIBRARY
AMERICAN INSTITUTE OF ACTUARIES

Books in the library may be consulted at any time by Fellows, Associates, and authorized representatives of Contributing Members.

Books may be withdrawn from the library by any member and retained for a period not exceeding two weeks. Such member assumes responsibility for the return to the library, in good condition, of any book withdrawn. If books are to be sent by mail or express, transportation charges will be paid by the Institute.

CONTENTS

PAGE

Board of Governors, Officers, and List of Members.......... v

Address of the President, George Graham 1

Surrender and Non-Forfeiture Values
By Percy H. Evans 12

Fundamental Annuities for Calculating Total and Permanent Disability Reserves Based on Hunter's Tables and 3 Per Cent Interest
By J. P. Bowerman 39

Benefits and Contributions under Retirement Systems
By Charles E. Brooks 57

An Actual Experience of the Double Indemnity Feature of the Life Insurance Policy
By R. Montague Webb......................... 77

A Review of Some of the Earlier Methods of Surplus Distribution, Some Proposed Methods, and Some Methods Currently in Use by Life Companies in the United States
By J. Charles Rietz 106

Application of the American Men Mortality Table to Financial Statements for Companies' Own Information
By E. L. Marshall........................... 142

Substandard Insurance: Its Evolution and a Review of Some of Its Principles
By Franklin B. Mead......................... 158

Underaverage Business with Special Reference to the Problems of a Young Company
By Arthur Hunter 187

PAGE
Discussion of Two Preceding Papers........................ 204

Impaired Life Tables.................................. 263

Book Reviews:

Mathematics of Finance, by H. L. RIETZ, A. R. CRATHORNE, and J. CHARLES RIETZ. Reviewed by CHARLES H. BECKETT.......................... 314

United States Life Tables, 1890, 1901, 1910, and 1901–10, by JAMES W. GLOVER. Reviewed by H. L. RIETZ.. 315

Income in the United States, Its Amount and Distribution, 1909–1919, by the STAFF OF THE NATIONAL BUREAU OF ECONOMIC RESEARCH. Reviewed by PERCY H. EVANS.................................. 316

A Treatise on Probability, by JOHN MAYNARD KEYNES. Reviewed by H. L. RIETZ....................... 317

Examination Questions............................ 318

Report of Treasurer................................ 330

Minutes of the Meeting of the American Institute of Actuaries 331

Constitution...................................... 335

By-Laws.. 339

AMERICAN
INSTITUTE OF ACTUARIES

THE BOARD OF GOVERNORS

Officers

President	Lawrence M. Cathles
Vice-President	James Fairlie
Secretary	George Benjamin Pattison
Treasurer	Bert Jay Stookey
Librarian	Edwin Richmond Carter
Editor of The Record	J. Chas. Rietz

Ex-Presidents

Henry Wright Buttolph
Oswald James Arnold
Joseph Howard Nitchie
Charles Harrison Beckett
George Graham

ELECTED MEMBERS

(To June, 1923)

Donald Francis Campbell
James Waterman Glover
*Julian C. Harvey

(To June, 1924)

Percy H. Evans

(To June, 1925)

Robertson G. Hunter
John G. Parker

---

* Appointed by the Board of Governors, upon resignation of J. Chas. Rietz, to serve until next annual meeting.

LIST OF MEMBERS

FELLOWS

Sinclair Edward Allison, A.A.S.
Pan-American Life Ins. Co., New Orleans, La.
Henry Willard Allstrom, A.A.S.
Minnesota Mutual Life Ins. Co., St. Paul, Minn.
Ernest Capron Ames, A.B., LL.B.
Bankers Life Ins. Co., Lincoln, Neb.
Lewis Albert Anderson, B.L.
Central Life Assurance Society of U.S., Des Moines, Iowa.
Charles Hart Angell, A.B.
Mass. Mutual Life Ins. Co., Springfield, Mass.
Troy Wilson Appleby, A.M.
Ohio National Life Ins. Co., Cincinnati, Ohio.
Oswald James Arnold, B.S.
Illinois Life Ins. Co., Chicago, Ill.
W. Nelson Bagley, B.S., F.A.S.
The Travelers Ins. Co., Hartford, Conn.
William Francis Barnard.
Syracuse, N.Y.
Samuel Barnett, A.B., C.E.
Atlanta, Ga.
Charles Harrison Beckett, A.B. (Mem. A.M.S.).
State Life Ins. Co., Indianapolis, Ind.
Judah Philip Bowerman.
George Washington Life Ins. Co., Charleston, W.Va.
George Burton Buck.
Municipal Bldg., New York City.
Consulting Office, 256 Broadway, New York City.
Russell Conklin Burton, A.B.
New World Life Ins. Co., Spokane, Wash.
Henry Wright Buttolph, A.M., A.A.S.
American Central Life Ins. Co., Indianapolis, Ind.
John Campbell Cameron, M.A., F.F.A., A.A.S.
Great Southern Life Ins. Co., Houston, Tex.
Donald Francis Campbell, A.M., Ph.D. (Mem. A.M.S.).
343 So. Dearborn St., Chicago, Ill.

FELLOWS

Francis Edgar Cann, M.A., F.A.S.
Southern Life and Trust Co., Greensboro, N.C.
Edwin Richmond Carter.
National Life Ins. Co. of U.S.A., Chicago, Ill.
Lawrence Maclagan Cathles, F.F.A., A.I.A., A.A.S.
Southland Life Ins. Co., Dallas, Tex.
Barret N. Coates.
Western States Life Ins. Co., San Francisco, Cal.
Arthur Coburn, F.A.S.
Northwestern Mutual Life Ins. Co., Milwaukee, Wis.
Ralph Bolles Coit.
Jefferson Standard Life Ins. Co., Greensboro, N.C.
Henry Richmond Corbett, B.Sc., Ph.M.
Insurance Exchange Bldg., Chicago, Ill.
James Douglas Craig, F.A.S.
Metropolitan Life Ins. Co., New York City.
Harald Worthington Curjel, M.A., F.I.A., A.A.S.
Illinois Life Ins. Co., Chicago, Ill.
Miles Meander Dawson, LL.D., F.A.S., F.I.A.
Suite 1005, 26 W. 44th St., New York City.
Frederick Adams Draper.
521 Miller Ave., Columbus, Ohio.
Earl Oglebay Dunlap.
Metropolitan Life Ins. Co., New York City.
James Strode Elston, A.B., F.A.S.
The Travelers Ins. Co., Hartford, Conn.
Saul Epsteen, Ph.D.
La Jara, Colo.
Percy H. Evans.
Northwestern Mutual Life Ins. Co., Milwaukee, Wis.
James Fairlie, M.A., A.A.S.
Mutual Life, of Illinois, Springfield, Ill.
E. G. Fassel.
Cleveland Life Ins. Co., Cleveland, Ohio.
James E. Flanigan, F.A.S.
Bankers Life Co., Des Moines, Iowa.

FELLOWS

Richard Fondiller, M.A., LL.B.
Equitable Life Assurance Society, 120 Broadway, New York City.
J. Burnett Gibb, F.F.A., A.I.A., F.A.S.
Penn Mutual Life Ins. Co., Philadelphia, Pa.
James Waterman Glover, A.M., Ph.D., F.A.A.S. (Mem. A.M.S.).
620 Oxford Road, Ann Arbor, Mich.
William H. Gould, M.A., A.I.A., A.A.S.
256 Broadway, New York City.
George Graham, F.F.A., A.A.S., A.I.A.
Central States Life Ins. Co., St. Louis, Mo.
Winfield W. Greene.
35 Nassau St., New York, N.Y.
Marcus Gunn, A.B.
American Central Life Ins. Co., Indianapolis, Ind.
Frank J. Haight.
810–813 Hume-Mansur Bldg., Indianapolis, Ind.
Alfred Gilbert Hann.
Pacific Mutual Life Ins. Co., Los Angeles, Cal.
Julian Corneille Harvey, LL.B.
Third National Bank Bldg., St. Louis, Mo.
Frank C. Hemsing, A.A.S.
Northwestern Mutual Life Ins. Co., Milwaukee, Wis.
Carl E. Herfurth.
Montana Life Ins. Co., Helena, Mont.
John E. Higdon, A.B.
Gates Bldg., Kansas City, Mo.
I. Smith Homans, A.A.S.
Commonwealth Life Ins. Co., Louisville, Ky.
Francis Moffat Hope, A.I.A., F.F.A.
Occidental Life Ins. Co., Los Angeles, Cal.
Arthur J. C. Huenergard, B.A., F.A.S.
Commonwealth Life Ins. Co., Omaha, Neb.
Charles Hughes, A.A.S.
Ins. Dept., New York City.
Arthur Hunter, F.F.A., F.A.S.
New York Life Ins. Co., New York City.

FELLOWS

Robertson G. Hunter, F.A.S., A.I.A.
Equitable Life Ins. Co., Des Moines, Iowa.
Wm. A. Hutcheson,
Mutual Life of New York, New York, N.Y.
Edward Wyllys Hyde, B.C.E., C.E.
Columbia Life Ins. Co., Cincinnati, Ohio.
Walter Irving King, A.B., F.A.S.
Connecticut General Life Ins. Co., Hartford, Conn.
John Melvin Laird, B.A., F.A.S., A.I.A.
Connecticut General Life Ins. Co., Hartford, Conn.
William Macfarlane, F.F.A., F.A.S.
New York Life Ins. Co., New York City.
Alexander T. Maclean.
Mass. Mutual Life Ins. Co., Springfield, Mass.
James McIntosh, F.F.A.
Minnesota Mutual Life Ins. Co., St. Paul, Minn.
Malcolm McNeill, Ph.D.
Lake Forest College, Lake Forest, Ill.
Erston L. Marshall, A.B., J.D.
323 Kraft Bldg., Des Moines, Iowa.
Franklin Bush Mead, A.B., F.A.S.
Lincoln National Life Ins. Co., Fort Wayne, Ind.
Henry Moir, F.F.A., F.I.A., F.A.S.
Home Life Ins. Co., New York City.
Paul Vaughan Montgomery, B.A.
Fort Worth Life Ins. Co., Fort Worth, Tex.
Edward B. Morris, Ph.B., F.A.S.
The Travelers Ins. Co., Hartford, Conn.
William Oscar Morris, A.A.S.
North American Life Ins. Co., Chicago, Ill.
William Ewart Napier.
Scranton Life Ins. Co., Scranton, Pa.
Joseph Howard Nitchie, A.B., F.A.S.
1523, 19 S. La Salle St., Chicago, Ill.
Bernhard Robert Nueske.
Old Colony Life Ins. Co., Chicago, Ill.
Robert Kelly Orr.
Lansing, Mich.

FELLOWS

Percy Charles Herbert Papps, A.I.A., F.A.S.
  Mutual Benefit Life Ins. Co., Newark, N.J.
John G. Parker, B.A., F.A.S., A.I.A.
  Imperial Life Assurance Co., Toronto, Ont., Can.
George Benjamin Pattison, A.A.S.
  Peoria Life Ins. Co., Peoria, Ill.
Oliver Winfred Perrin, B.A., M.A., F.A.S.
  Penn Mutual Life Ins. Co., Philadelphia, Pa.
Shaffner Leonard Phelps, B.S.
  Lincoln National Life Ins. Co., Fort Wayne, Ind.
Thomas Ashley Phillips, A.B., A.A.S., A.I.A.
  Minnesota Mutual Life Ins. Co., St. Paul, Minn.
Sidney Herbert Pipe, F.A.S., A.I.A.
  Temple Bldg., Toronto, Canada.
Joseph B. Reynolds.
  Kansas City Life Ins. Co., Kansas City, Mo.
Edward E. Rhodes, F.A.S.
  Mutual Benefit Life Ins. Co., Newark, N.J.
Henry Lewis Rietz, B.Sc., Ph.D., F.A.A.S., F.R.S.S. (Mem. A.M.S.).
  University of Iowa, Iowa City, Iowa.
J. Charles Rietz, A.B. (Mem. A.M.S.)
  Midland Mutual Life Ins. Co., Columbus, Ohio.
John Francis Roche, F.A.S.
  Manhattan Life Ins. Co., New York City.
George Roslington, F.C.A., A.I.S.
  Occidental Life Ins. Co., Albuquerque, N.M.
George White Sanders, A.B., F.A.S.
  Michigan Mutual Life Ins. Co., Detroit, Mich.
Jacob Charles Seitz, A.B.
  Security Life Ins. Co. of America, 1101 The Rookery, Chicago, Ill.
Andrew Sigtenhorst.
  Texas Life Ins. Co., Waco, Tex.
Alexander Albert Speers, B.A., F.A.S.
  North American Life Ins. Co., Omaha, Neb.
Calvert Frederick Stein.
  Maryland Assurance Corporation, Baltimore, Md.

FELLOWS

Bert J. Stookey.
Illinois Life Ins. Co., Chicago, Ill.
Wendell M. Strong.
Mutual Life Ins. Co. of New York, New York, N.Y.
Gordon William Thomson, F.F.A., A.I.A., A.A.S.
West Coast Life Ins. Co., San Francisco, Cal.
Carleton M. Vail, A.B.
1005, 110 S. Dearborn St., Chicago, Ill.
James H. Washburn, A.A.S.
165 Broadway, New York City.
William Arthur Watt, M.A., F.A.S.
Southern Life and Trust Co., Greensboro, N.C.
Robert Montague Webb.
Kansas City Life Ins. Co., Kansas City, Mo.
A. A. Welch, A.B.
Phoenix Mutual Life Ins. Co., Hartford, Conn.
Romeo Meran Wilbur.
549 Railway Exchange Bldg., Chicago, Ill.
Frederick Alfred Williams, F.A.S., A.I.A., F.S.S.
Apartado 1420, Mexico City, Mexico.
Frederic Scherer Withington.
402–404 Kraft Bldg., Des Moines, Iowa.
Joseph Hooker Woodward.
Equitable Life Assurance Society, New York City.
Paul Livingston Woolston, B.S.
1636 E. Eighth Ave., Denver, Colo.

ASSOCIATES

Albert Babbitt, A.M.
    The Lamar Life Ins. Co., Jackson, Miss.
Henricka Bryant Beach, M.A.
    Provident Ins. Co., Bismarck, N.D.
Benjamin S. Beecher, A.M.
    National Guardian Life Ins. Co., Madison, Wis.
George Walter Bishop.
    The Bankers Reserve Life Co., Omaha, Neb.
Lester A. Bosworth, B.S., A.A.S.
    Continental Life Ins. Co., Wilmington, Del.
Lorne T. Boyd.
    Northwestern Life Assurance Co., Winnipeg, Canada.
Walter Gregory Bowerman, M.A., A.A.S.
    New York Life Ins. Co., 346 Broadway, New York City.
William Edgar Brimstin.
    Federal Life Ins. Co., Chicago, Ill.
Charles Edward Brooks.
    613 Insurance Bldg., Madison, Wis.
Everett G. Brown.
    Southwestern Life Ins. Co., Dallas, Tex.
Helen E. Brown.
    19 Niles St., Hartford, Conn.
Helmuth G. Brunnquell.
    Ins. Dept., Madison, Wis.
Harold Hibbs Buckman.
    California State Life Ins. Co., Sacramento, Cal.
Charles J. Burkart.
    Kansas City Life Ins. Co., Kansas City, Mo.
Helen L. Clark.
    American Central Life Ins. Co., Indianapolis, Ind.
Arturo H. Clement.
    La Mundial Ins. Co., Santiago, Chili.
Wendell Phillips Coler, A.B.
    The Maccabees, 5065 Woodward Ave., Detroit, Mich.
John Alexander Copeland, A.B.
    124–126 Hury Bldg., Atlanta, Ga.
O. A. Ehrenclou.
    550 W. 146th St., New York, N.Y.

ASSOCIATES

Edward B. Escott.
Audit Bureau of Circulations, Century Bldg., Chicago, Ill.
Harry C. Fetsch, B.A., A.A.S.
Ohio State Life Ins. Co., Columbus, Ohio.
A. C. Good.
Great Southern Life Ins. Co., Houston, Tex.
Clarence R. Goodrich.
State Insurance Dept., Jefferson City, Mo.
Irvin Lorenzo Grimes, A.B.
Mutual Trust Life Ins. Co., Stock Exchange Bldg., Chicago, Ill.
Robert N. Griswold, A.A.S.
Inter-Mountain Life Ins. Co., Salt Lake City, Utah.
John V. Hanna.
United Life and Accident Ins. Co., Concord, N.H.
W. J. Hiller, A.B.
Bankers Life of Nebraska, Lincoln, Neb.
Grady Hayne Hipp, A.B.
New York Ins. Dept., Albany, N.Y.
George William H. Huskinson.
1127 Easton St., Alton, Ill.
Wilbur M. Johnson, A.M.
The Surety Fund Life Co., Minneapolis, Minn.
Frank Russell Jordan, B.A., A.A.S.
Franklin Life Ins. Co., Springfield, Ill.
Arthur W. Larsen, M.A., A.A.S.
Volunteer State Life Ins. Co., Chattanooga, Tenn.
R. C. McCankie.
Equitable Life Ins. Co. of Iowa, Des Moines, Iowa.
H. C. Marvin, A.M.
812 Hume-Mansur Bldg., Indianapolis, Ind.
Joseph Duryea Maynard.
Northwestern Mutual Life Ins. Co., Milwaukee, Wis.
George Myers.
Missouri State Life Ins. Co., St. Louis, Mo.
Gertrude L. Pardieck.
State Life Ins. Co., Indianapolis, Ind.
Elder A. Porter.
Indianapolis Life Ins. Co., Indianapolis, Ind.

ASSOCIATES

Euclid Leonidas Porter.
Volunteer State Life Ins. Co., Chattanooga, Tenn.
John M. Powell, A.B., A.A.S.
Columbian National Life Ins. Co., 77 Franklin St., Boston, Mass.
Henry Reichgott, Ph.B., A.A.S.
Missouri State Life Ins. Co., St. Louis, Mo.
John F. Reilly, M.A.
University of Iowa, Iowa City, Iowa.
Rainard B. Robbins.
Insurance Department, Albany, N.Y.
Stanford Z. Rothschild, A.B., A.A.S.
Sun Life Ins. Co. of America, Baltimore, Md.
Martin Rowley Scott.
Royal Union Mutual Life Ins. Co., Des Moines, Iowa.
Henry G. Sellman, A.B.
407 Olive St., St. Louis, Mo.
Clinton O. Shepherd, A.A.S.
Missouri State Life Ins. Co., St. Louis, Mo.
Coll C. Sinclair, B.A.
Great-West Life Assurance Co., Winnipeg, Man., Can.
Guy L. Stayman.
Reserve Loan Life Ins. Co., Indianapolis, Ind.
Fred David Strudell.
American Life Reins. Co., Dallas, Tex.
Robert B. Sturtevant.
American Central Life Ins. Co., Indianapolis, Ind.
Toshikazu Suzuki, M.S.
The First Mutual Life Ins. Co., Kyobashi, Tokio, Japan.
Verne L. Tickner.
International Life Ins. Co., 331 Fourth Ave., Pittsburgh, Pa.
Roger Sherman Vail, A.B.
1005, 110 S. Dearborn St., Chicago, Ill.
Bernard Werkenthin.
Ins. Dept., Austin, Tex.
Horace Scoville Wiggins, C.P.A.
514-515 Bankers Life Bldg., Lincoln, Neb.
Helen J. Williams, A.B., M.S.
Lincoln National Life Ins. Co., Fort Wayne, Ind.
Jens Peter Yort.
Masonic Mutual Life Association, Washington, D.C.

CONTRIBUTING MEMBERS

Aetna Life Insurance Co.	Hartford, Conn.
American Bankers Insurance Co	Chicago, Ill.
American Central Life Insurance Co.	Indianapolis, Ind.
American Life Insurance Co	Denver, Colo.
American National Life Insurance Co	Galveston, Tex.
Amicable Life Insurance Co.	Waco, Tex.
Atlantic Life Insurance Co.	Richmond, Va.
Bank Savings Life Insurance Co.	Topeka, Kan.
Bankers Life Co	Des Moines, Iowa
Bankers Reserve Life Co.	Omaha, Neb.
Canada Life Insurance Co.	Toronto, Can.
Capitol Life Insurance Co. of Colorado.	Denver, Colo.
Cedar Rapids Life Insurance Co	Cedar Rapids, Iowa
Central Life Assurance Society	Des Moines, Iowa
Central Life Insurance Co. of Illinois.	Ottawa, Ill.
Central States Life Insurance Co.	Crawfordsville, Ind.
Central States Life Insurance Co.	St. Louis, Mo.
Cleveland Life Insurance Co	Cleveland, Ohio
Columbia Life Insurance Co	Cincinnati, Ohio
Columbus Mutual Life Insurance Co.	Columbus, Ohio
Connecticut General Life Insurance Co.	Hartford, Conn.
Dakota Life Insurance Co.	Watertown, S.D.
Elkhorn Life and Accident Insurance Co	Norfolk, Neb.
Equitable Life Insurance Co. of the District of Columbia,	Washington, D.C.
Equitable Life Insurance Co. of Iowa.	Des Moines, Iowa
Farmers and Bankers Life Insurance Co.	Wichita, Kan.
Federal Life Insurance Co.	Chicago, Ill.
Fidelity Mutual Life Insurance Co.	Philadelphia, Pa.
Fort Worth Life Insurance Co	Fort Worth, Tex.
Franklin Life Insurance Co	Springfield, Ill.
George Washington Life Insurance Co.	Charleston, W.Va.
Great Northern Life Insurance Co	Chicago, Ill.
Great Southern Life Insurance Co.	Houston, Tex.
Great-West Life Assurance Co	Winnipeg, Man., Can.
Guaranty Life Insurance Co	Davenport, Iowa
Guardian Insurance Co	Madison, Wis.
Guardian Life Insurance Co. of America	New York, N.Y.

CONTRIBUTING MEMBERS

Idaho State Life Insurance Co	Boise, Idaho
Illinois Life Insurance Co	Chicago, Ill.
Indiana National Life Insurance Co	Indianapolis, Ind.
Indianapolis Life Insurance Co	Indianapolis, Ind.
Inter-Mountain Life Insurance Co	Salt Lake City, Utah
International Life Insurance Co	St. Louis, Mo.
Iowa Life Insurance Co	Waterloo, Iowa
Jefferson Standard Life Insurance Co	Greensboro, N.C.
John Hancock Mutual Life Insurance Co	Boston, Mass.
Kansas City Life Insurance Co	Kansas City, Mo.
La Fayette Life Insurance Co	La Fayette, Ind.
Lamar Life Insurance Co	Jackson, Miss.
Lincoln National Life Insurance Co	Fort Wayne, Ind.
Maryland Life Insurance Co	Baltimore, Md.
Massachusetts Mutual Life Insurance Co	Springfield, Mass.
Merchants Life Insurance Co	Des Moines, Iowa
Metropolitan Life Insurance Co	New York City, N.Y.
Michigan Mutual Life Insurance Co	Detroit, Mich.
Midland Life Insurance Co	Kansas City, Mo.
Midland Mutual Life Insurance Co	Columbus, Ohio
Minnesota Mutual Life Insurance Co	St. Paul, Minn.
Missouri State Life Insurance Co	St. Louis, Mo.
Montana Life Insurance Co	Helena, Mont.
Mutual Benefit Life Insurance Co	Newark, N.J.
Mutual Life of Illinois	Springfield, Ill.
Mutual Trust Life Insurance Co	Chicago, Ill.
National Life and Accident Insurance Co	Nashville, Tenn.
National Life Insurance Co	Montpelier, Vt.
National Life Insurance Co. of the U.S.A	Chicago, Ill.
New England Mutual Life Insurance Co	Boston, Mass.
North American Life Insurance Co	Chicago, Ill.
Northern Assurance Company of Michigan	Detroit, Mich.
Northern Life Insurance Co	Seattle, Wash.
Northwestern National Life Insurance Co	Minneapolis, Minn.
Occidental Life Insurance Co	Los Angeles, Cal.
Ohio National Life Insurance Co	Cincinnati, Ohio
Ohio State Life Insurance Co	Columbus, Ohio
Old Colony Life Insurance Co	Chicago, Ill.

CONTRIBUTING MEMBERS

Old Line Life Insurance Co	Milwaukee, Wis.
Pacific Mutual Life Insurance Co.	Los Angeles, Cal.
Pan-American Life Insurance Co	New Orleans, La.
Peoples Life Insurance Co.	Chicago, Ill.
Peoples Life Insurance Co.	Frankfort, Ind.
Peoria Life Insurance Co	Peoria, Ill.
Phoenix Mutual Life Insurance Co.	Hartford, Conn.
Philadelphia Life Insurance Co	Philadelphia, Pa.
Provident Life and Trust Insurance Co.	Philadelphia, Pa.
Prudential Life Insurance Co. of America	Newark, N.J.
Public Savings Life Insurance Co. of America	Indianapolis, Ind.
Register Life Insurance Co.	Davenport, Iowa
Reinsurance Life Company of America	Des Moines, Iowa
Reliance Life Insurance Co	Pittsburgh, Pa.
Reserve Loan Life Insurance Co	Indianapolis, Ind.
Royal Union Mutual Life Insurance Co.	Des Moines, Iowa
Scranton Life Insurance Co	Scranton, Pa.
Security Life Insurance Co. of America	Chicago, Ill.
Southland Life Insurance Co	Dallas, Tex.
Southwestern Life Insurance Co.	Dallas, Tex.
Standard Life Insurance Co	St. Louis, Mo.
State Life Insurance Co.	Indianapolis, Ind.
Travelers Life Insurance Co.	Hartford, Conn.
Two Republics Life Insurance Co.	El Paso, Tex.
Union Central Life Insurance Co	Cincinnati, Ohio
Volunteer State Life Insurance Co.	Chattanooga, Tenn.
West Coast Life Insurance Co.	San Francisco, Cal.
Western Reserve Life Insurance Co.	Muncie, Ind.
Western States Life Insurance Co.	San Francisco, Cal.
Western Union Life Insurance Co.	Spokane, Wash.
Wisconsin Life Insurance Co.	Madison, Wis.
Wisconsin National Life Insurance Co	Oshkosh, Wis

DECEASED MEMBERS

Carroll Booth Carr
Horton Woods Cochnower
Isaac Davenport
John Maynard Emery
Virgil Morrison Kime
Louis Linzmeyer
Lucius McAdam
Nels Nelson
Albert Garfield Portch
Henry Sherman Vail
Geert Andries Van der Sluis
Harris Eli Vineberg
Benjamin A. Welstead
Wilbur Sylvester Wynn

ADDRESS OF THE PRESIDENT, GEORGE GRAHAM

A principal desideratum in attempting to draw conclusions from a group of vital statistics is that there shall be a sufficient volume to produce average results.

Most of those gathered here today represent the younger companies whose volume of business is not yet sufficient to permit of an analysis of their mortality experiences from which reliable conclusions can be drawn. The actuaries of the older companies which have large volumes of seasoned business on their books have this advantage over us that without going outside their own offices they have access to groups of data which in themselves are sufficiently extensive to furnish much valuable information.

Paucity of data should not deter us, however, from making periodical investigations in a systematic manner of our own companies' statistics because in the natural course of events the data will accumulate to proportions which will ultimately yield information to us of a worth while character; in the meantime much of value may be extracted from even a meagre volume of statistics so that errors of practice may be corrected or opinions checked, thereby giving us increased confidence in developing the business of our companies along safe and sound lines.

In any analysis that may be made it is important that the substandard business, however limited it may be, shall be kept apart from that written at standard rates because it is not at all impossible that an experience of even a most meagre volume of substandard business might if included with the general experience result in erroneous conclusions being drawn.

At the risk of repetition, I would like to stress the imperative need of the younger companies providing themselves immediately with a proper system of records and collating the data from their own experience for their guidance. They should not wait to do this until they have accumulated a volume of business because although the need will not be apparent in the early stages of the company's development, much that will be of value to them in later years may thereby be completely lost.

Fortunately for us the actuaries who have access to statistics of good volume have evinced a willingness to give us the full benefit of the results of their research and while not neglecting the lessons that can safely be drawn from the limited experience of our own companies we must take full advantage of the wealth of valuable information that is so generously made accessible to us.

The most important contribution of recent times is the report of the Committee of the American Canadian Mortality Investigation, 1900 to 1915. I venture to say that this report is of more real value to the companies which did not contribute to the investigation than to those which did. Many of the contributing companies already had their own experience tabulated and were doubtless fully informed of the trend of the mortality. The Committee's report merely confirmed their findings or indicated wherein their experiences differed from the general experience of the contributing companies.

Undoubtedly much additional valuable information has since been accumulated and in course of time we can hope that it will again be made available to us, although it should be borne in mind that in undertaking such an investigation the companies and their officers place upon themselves a very great burden of effort and expense. Realizing this, we are all the more appreciative of what they have already done and will be not less grateful for future like favors.

Of course, it is yet too early to think about another similar investigation but many important developments have taken place since the close of that investigation. The World War and the influenza have both left their mark, the latter especially has complicated the situation; nevertheless it may be of some interest to us to turn for a moment to such data as is at present available to us and perhaps we can find some things of interest and value as indicative of what may be looked for in the future.

You will recall that in the opening chapter of the British Institute text book dealing with the law of mortality it is stated that just as the search for the philosopher's stone led to great and useful discoveries in chemistry, so the quest after a law of human mortality has resulted in the development of mathematical formulae which have been of great practical benefit to actuaries.

These formulae developed for the purpose of graduating the crude statistics used in the construction of the mortality tables and for otherwise simplifying our work, have been found to reproduce very closely the original figures of various investigations of life insurance companies and population statistics and have been proved to represent closely the law of mortality as it applies to the particular circumstances of these investigations.

If there is a mathematical expression which may be used to interpret the law of mortality it must be of an exceedingly flexible form, a form which will make allowance for every variant in the circumstances and modes of life of the endless groups which are subjects for such investigations.

Is it unreasonable to expect that the component parts of these formulae may be found to be close reproductions of the death rates from various homogeneous groups of "Causes of Death"?

Benjamin Gompertz seems to have been the first to have theorized on the causes of death which he states may be the consequence of two generally co-existent causes, "the one chance without previous disposition to death or deterioration, the other deterioration or increased inability to withstand destruction."

Gompertz recognized the deteriorating influences of advancing age but it was outside of his experience or perhaps it was not applicable to his times that certain diseases, excluding those of childhood, manifest their fullest virulence in early manhood and advancing years instead of adding to the dangers of death from these causes actually seem to afford a stouter armor of protection against them. We also know that both these causes cited by Gompertz can be offset to a greater or less extent by many present day agencies such as health boards, public interest and education and increased medical and surgical skill which were not then available.

A study of some of the causes of death as these are set forth in the mortality statistics of the Census Bureau and in the published reports of the companies' investigations may be interesting to us in determining to some extent not only the trend of the mortality but also the effectiveness of our selection.

In considering the trend of mortality the general population statistics are likely to show results not greatly different from those which we may expect to apply to insured lives and a very convenient source for which to refer for this information is the annual publication of the Bureau of Census supplemented by the special tables published in 1910 and 1921.

Each year the Bureau of Census publishes the death rate by causes for the registration area of the United States and comparisons are possible from year to year which show the general trend as to the whole population in the registration area and also by registration states and cities of one hundred thousand population or more.

In the report of the American Canadian Investigation there was included a tabulation of the deaths by causes showing the percentage from each cause of total deaths and the Death Rate from each cause by groups of ages and insurance years.

In the Medico Actuarial Mortality Investigation it will be recalled that tables of proportions of deaths due to various causes were prepared for comparison with similar tables based on the lives of those engaged in hazardous occupations or showing medical impairments; the data was not presented in exactly similar form to that used in the newer American-Canadian Investigation. It is hoped that tabulations of future investigations will be made available in a form suitable for comparison with the records of the past as such comparisons will be of very great value in indicating the trend of mortality.

First among the causes of death of outstanding importance is typhoid fever. The death rate per hundred thousand of population in 1900 was 35.9, 1910, 23.5, in 1915, 12.4 and in 1919, 9.2, an exceedingly satisfactory continuous diminishment in the ravages of this disease.

Medical authorities hold out the hope that the day will come when typhoid, already a medical curiosity in some localities, will become like smallpox, a negligible factor in our mortuary returns.

Further hope that this happy condition is possible can be found in the statistics for Massachusetts which in 1911 experienced a death rate of 9.1 per hundred thousand of population and an almost uniform reduction year by year from then until 1919 when the lowest rate reported up to that time, namely 2.7, was reached.

Other states with commendably low rates are Vermont, Wisconsin, New Jersey, Minnesota, Rhode Island and New Hampshire, all with a rate of less than 3.5 per hundred thousand in 1919. The states showing the highest death rates are those where large colored populations prevail, the highest being Tennessee with a rate of 28.0 per hundred thousand in 1919.

Turning to the American Canadian Investigation we find that the death rate from typhoid was actually highest at the younger ages at death and during the earliest insurance years and that this and other epidemic diseases demand their heaviest toll from the youngest insured lives. Medical selection as at present practiced has but little effect in protecting life insurance companies from this source of loss. The rejection of an applicant whose personal and family history indicates an inherent lack of resistance to disease may afford us some little protection but the relief will continue to come from directing the attention of the general public to improved methods of living that avoid such diseases.

We must bear in mind, however, that the death rate from typhoid does not tell the whole story because we know that for several years following an attack of typhoid the possibility of death from tuberculosis, heart and kidney diseases is greatly increased.

All forms of tuberculosis show a death rate per hundred thousand of population in the registration area of 201.9 for 1900, 192.3 for 1905, 160.3 for 1910, 146.4 for 1915 and 125.6 for 1919, an encouraging, steady downward tendency which was apparently interrupted only temporarily by the ravages of the influenza in 1918. The possibilities of further improvement may be indicated by the fact that in 1919 the death rate for Utah was only 44.8, in Kansas 50.6; Indiana has succeeded in reducing its death rate from 171.2, the average rate for the period from 1906 to 1910 to 114.1 in 1919. Missouri has reduced its rate from 154.6 in 1911 to 117.2 in 1919.

In the cities we have New York effecting a reduction in its death rate from 210.6 in 1911 to 153.1 in 1919, St. Louis from 158.7 in 1911 to 112.6 in 1919, Milwaukee from 107.7 in 1911 to 83.4 in 1919, Spokane from 117.9 in 1911 to 67.2 in 1919, the lowest rate of any of the larger cities.

Nowhere do we find medical selection more helpful to us than in the elimination of those who are afflicted with tuberculosis or show a predisposition thereto.

The efficacy of this selection is, as might be expected, most evident during the first insurance years and the rate quickly ascends to the ultimate. To this cause can be largely attributed the rapid diminishment at the younger ages in the benefits of selection.

The death rate from cancer in the general population shows a tendency to increase. In 1900 the death rate was 63 per hundred thousand, in 1905, 71.4; in 1910, 76.2; in 1915, 81.4; in 1917, 82.0, but in 1918 and 1919 a slight reduction is shown to 80.4 and 80.5, respectively.

Cancer is hardly significant as a cause of death until after age 40. Turning to the American Canadian Investigation we find that the death rates from this source for ages 50 and over are practically as high in the years immediately following selection as in later years, indicating that the medical examiners have not been so successful in protecting the companies from those afflicted or threatened with this as with other diseases. The known difficulty of diagnosing the disease is well brought out in this group.

The Canadian statistics indicate greater effectiveness in protecting the companies against the ravages of this disease in the years immediately following examination than do the figures for the United States. Taking the group of ages at death 50 to 59 the experience among American Men shows a ratio per 10,000 exposed to risk for the first year of 10.5, the second year 14.1, the third, fourth, and fifth years 10.0, and for the sixth and subsequent years 12.4. In the Canadian experience the ratios for the same age groups are 1.9 for the first year, 3.0 for the second year, 7.3 for the third, fourth, and fifth years, and 10.4 for the sixth and subsequent years.

Deaths from cerebral hemorrhage and apoplexy also show an upward tendency from 67.5 per hundred thousand of population in 1900, 71.6 in 1905; 73.7 in 1910; 79.6 in 1915; 83.3 in 1917; again with a downward tendency in 1918 and 1919 of 79.9 and 77.5, respectively.

The American Canadian Mortality Committee's report indicates that selection has been quite effective in the early years in protecting the companies against those in immediate danger of death from this cause and it is reasonable to suppose that the examiners' efficiency in this respect with the aid of instruments for taking the blood pressure readings will tend to increase still further their effectiveness.

Diseases of the heart caused a death rate per hundred thousand of population of 123.1 in 1900, 143.8 in 1905, 150.4 in 1910, 156.8 in 1915, 162.7 in 1917, a steady upward tendency, but 1918 showed a drop to 161.6 and 1919 to 138.0.

Acute nephritis and Bright's disease was responsible for a death rate of 89 in 1900, of 103.4 in 1905, 99.0 in 1910, 105.1 in 1915, 107.9 in 1917, dropping to 97.6 in 1918 and 88.1 in 1919.

The improvements in the rates for cancer, apoplexy, diseases of the heart, acute nephritis, and Bright's disease indicated for the years 1918 and 1919 do not prevail to the same extent when comparison is confined to the population in the original registration areas, and if the investigations were confined to the original registration areas the death rates from these causes between the years 1900 and 1917 would show uniformly greater increases. In these States greater accuracy can be expected in reporting causes of death.

In dealing with the population statistics the age distribution of the population and the effects of immigration and emigration must always be kept in mind. The age distribution in the states which were not a part of the original registration area and the effects of immigration are doubtless reflected in the lower death rates in these states from the degenerative diseases as compared with the experience in the older and more settled states where a larger proportion of the population will have attained to the more advanced ages.

It would be very encouraging were we able to accept the census statistics of the death rates from cancer, apoplexy, heart and Bright's diseases at their face value, but the uniform improvement in the death rate from these causes in 1918 and 1919 is difficult to accept as indicative of a permanent downward trend. May it not be significant that 1918 and 1919 were the years of the influenza epidemic when doubtless many deaths were reported from this cause which in the normal course of events, without any visitation of influenza, would have occurred from one or other of the degenerative diseases which had possibly already laid hold on these lives?

The statistics in the American Canadian Committee's report relating to diseases of the kidneys and the nervous and circulatory systems well illustrates the efficiency of the examiners so far as the early years of insurance are concerned. The greatest benefit is noticeable at the older ages and the elimination of lives suffering from such impairments has undoubtedly contributed greatly to the substantial savings from selection evident at these older ages during the early insurance years.

Deaths from external causes averaged 107.9 for the period 1906 to 1910, 104.7 for the period 1911 to 1915, 90.9 for 1919. Automobile accidents and injuries showed a steady climb from zero to 9.4 in 1919, offset to a considerable extent, however, by the reduction in deaths by railroad accidents from 15, the average for the period 1906 to 1910, to 7.4 for 1919; street car accidents show a downward trend from 3.7 for the period 1906 to 1910, to 2.3 for 1919; other vehicles showed a ratio of 4.0 for the period 1906 to 1910 and 2.3 for 1919.

I am coming to the opinion that the automobile, the railroad and the street car should be combined under one heading because under present day conditions they all form a part of our transportation system and the automobile is to a very great extent taking the place of the railroad and street car in the handling of some of our transportation problems.

Accidental drownings also showed a satisfactory improvement from 9.6, the average for 1906 to 1910, to 6.9 for 1919.

In summing up an investigation of the causes of death among the general population, the indications are that at the younger insurance ages where the acute and infectious diseases and tuberculosis exact their heaviest toll we have reason to hope for continued improvement in the death rate, not, however, to the same extent as has been observed in the last several decades.

At the older ages it cannot be claimed that there is as yet any well defined improvement; on the contrary, excluding the years 1918 and 1919, the degenerative diseases seem to continue to demand an ever increasing number of victims. Until the statistics for years subsequent to 1919 are available it would be rash to predict that a permanent decrease in the death rate from these causes has taken place.

Turning to the United States Life tables published by the Bureau of Census in 1921 we find a number of interesting mortality tables, among which are the experience on white males and white females in the original registration states identified as 1901, 1901 to 1910, and 1910.

A constant improvement is shown in the rate of mortality up to age 45 among the white males and up to age 55 among the white females. Above age 45 in the case of white males and 55 in the case of white females, except at the extreme ages of the table, there is a well defined tendency for the mortality to increase.

A similar trend is noted in the statistics of the State of Massachusetts among white males. The tendency has been downward from 1890 to 1910 up to age 55 but thereafter, except at the extreme ages of the table, the tendency has been definitely upward.

Authorities are agreed that conditions in the United States are more nearly like to those which prevail in Australia and England. Both the Australian and the English Life Tables show at all insurable ages, except ages above 50 in the case of England, substantially lower death rates than prevail among the population of the United States and we are, therefore, encouraged to hope that still further reductions are possible in this country at the principal insurable ages.

The mortality rate in Norway and Sweden for ages between 35 and 85 indicates that if we could duplicate the conditions which prevail there we might hope for satisfactory improvement in the death rate in this country at these ages which at present afford us most cause for concern.

We would naturally prefer to take the hopeful view that under present day conditions the death rate at all ages is yielding to the onslaughts of intelligent effort, but while this is readily admitted to be true, being amply verified not only from the population statistics but also from those of the life insurance companies, at all ages up to middle life, from that point on there is but little concrete evidence to indicate that we are even holding our own. To life insurance men this must mean that while present day revisions of rates may be slightly downward at the younger insurance ages those at the older ages must for the present at all events remain unchanged, if in fact there is not some need for increased rates or more stringent standards of selection at ages above 50.

As my term of office is drawing to a close I wish to take this opportunity to thank you again for the honor which you bestowed on me. It has been made a most enjoyable experience by the splendid spirit of co-operation evinced by all of you. It is your Institute and such progress as has been made has only been possible through your interest in its welfare and the members themselves are entitled to the credit. Each one of you has performed the full service asked of him.

Naturally the demands made on some have been greater than on others. Those who served on the various committees have given of their time ungrudgingly and to them the thanks of the Institute are due.

It is difficult to pick out any particular committee but if I were to select one for special mention it would be the Committee on

Examinations. The work of this committee is increasing very rapidly. It has been enlarged twice during my term of office and I hope that it will be found necessary to continue to enlarge it still further. It has reduced to a minimum the period of suspense for the candidates between the time of writing their examinations and the announcement of the results. More important than that, however, it has established standards of proficiency which amply assure that those who attain to the high degree of Fellowship in the Institute by examination shall be soundly equipped to assume the responsibilities that are bound to come to them.

We find that an increasing number of candidates are presenting themselves each year to write our examinations. In 1921, 153 papers were written with 89 passes and 179 papers in 1922 with 93 passes. The institute rolls of both Fellows and Associates are steadily increasing by the admission of new members by examination; this in my opinion is the surest and most satisfying sign of the progress being made by the Institute for it is to these younger men that the responsibility will fall to carry on the work of the Institute.

I would like to be permitted to say a word regarding a special committee which we formed last year and for lack of a better term called the Students' Aid Committee. This Committee consists of 24 Fellows, each one of whom has undertaken on some particular subject to help by correspondence Associates studying for the Fellowship examinations; I believe a start was made last year by this Committee in rendering a service of particular value to our Associates who are handicapped considerably because of the widely scattered field over which they are located. The Institute is indebted to those Fellows who rendered service on this Committee and until something better is devised may I express the hope that it will be continued.

Another matter I would like to touch on briefly is the establishment of permanent headquarters. As you know a special committee was appointed to investigate but it was compelled to report that the finances of the Institute at the present time do not warrant this important step. Speaking from the experience I have acquired in the past two years I cannot too strongly urge on the Institute the inestimable value and importance of establishing permanent headquarters at some central point in the very near future. Not only do we need proper accommodations for our library, which is being constantly increased, but there is a multiplicity of detail work and the time in my opinion has already been reached when it is almost unreasonable to ask honorary officials to attend to such routine matters. A paid assistant secretary is an almost immediate necessity. Only those in close touch with the affairs of the Institute can fully appreciate the amount of time that must be given to their duties by the secretary, the treasurer, the editor, and the librarian. I believe that the time is close at hand when these things will be possible.

We are experimenting at our present meeting with a plan to have the discussion of some of the papers follow immediately the presentation and to this end we have had galley proofs of these papers distributed to the members. We are very conscious of the fact that but little time has been given to the members to study the proofs of these papers but it is hoped that the valueof the discussion will not suffer.

To many of us a most interesting and valuable part of our program in the past has been the informal discussions that have developed on the floor regarding matters of immediate practical importance to us and it would be very disappointing if the change in the procedure were to detract from this phase of our meetings.

As a last word, may I ask that everyone who has a thought to express on any of the subjects that come before us at these meetings will give to all the benefit of it.

SURRENDER AND NON-FORFEITURE VALUES

BY PERCY H. EVANS

Policy provisions relating to cash surrender and non-forfeiture have an importance to the purchasers of life insurance beyond any other part of the contract except payment of the claim when due. The conditions of competition and legislation existing in America have resulted in an evolution of this part of the life insurance policy along radical lines to a practice more nearly approximating the limit than in other countries. The outstanding peculiarity of this evolution is the extent to which experiments originating in competition have been crystallized in statutory requirements, thus depriving the companies of freedom of action except within very narrow limits.

A president of the British Institute remarked as long ago as 1879 that surrender values, so far as the public is concerned, will always be unsatisfactory, the popular notion being that the company should upon surrender return the premiums in full, with a debatable question whether these premiums should be refunded with interest. A great many policyholders still entertain that opinion. On the other hand the practice of promising liberal cash and non-forfeiture values which has found its maximum development in the United States may have been a predominant factor in the remarkable expansion of life insurance in this country. An example of the opposite extreme is found in the policy of the Australian Mutual Provident Society which contains no reference to non-forfeiture except a provision that after two years the policy will not lapse as long as the cash value "as fixed by the Board" is sufficient to cover the premium. The Australian Mutual Provident pays cash surrender values according to circumstances as determined by its Board. These values run from 75 to 90 per cent of the reserve. For European practice see *Influence of Competitive Concessions on Legislation* by J. B. Lunger, 1914.

The enactment of the first policy valuation liability law in Massachusetts in 1858 led to the tabulation of policy reserves per $1,000. Since the reserve shares as they appear in this table were created by the excess of net premium payments and interest over current and past mortality costs it was natural that from the use of the tables there began to grow the conception of the reserve share as belonging equitably to the individual insured. This idea was in conflict with the best thought of the time, which held that the assets of the company belonged to the entire membership as a community and that the tabulation of reserves per $1,000 was a mere bookkeeping convenience in dealing with averages and had no basis in fact. (See "Liberality of Modern Policies" by Henry Moir, *T.A.S.*, October, 1911; "Individual Reserves in Life Insurance" by H. S. Buttolph, *Record A.I.A.*, June, 1919.) In any company there will be impaired or even moribund lives as to which the true liability approaches the face amount of the insurance, thus reducing the shares of the healthy lives below the average or tabulated reserves. The logic of this supposition is that a system of surrender allowances granting an approximation of the tabulated policy reserve will result in withdrawals of healthy lives since they will receive more than their true share while the invalid lives will continue their insurance because they are not offered, in proportion to their impairment, more than the average or valuation reserve. But logic is not necessarily wisdom. The validity of the conclusion outlined depends upon certain psychological considerations. In the Massachusetts Insurance Report of 1860 the commissioners said they could hardly believe that the vitality of holders of lapsed policies ever had been or ever would be appreciably above the average vitality of those who continue.

We should of course think clearly about the individual versus the community conception of reserves but it is scarcely worth while to argue about it since in this country the legal status of individual reserves is beyond question. The idea of the policyholder's right to the "equitable value" of his policy received judicial notice in a line of cases arising from the Civil War. (See *New York Life* v. *Statham*, U.S. Reports, Vol. 93.)

The history of surrender values is obscure both in this country and in Great Britain since the early practice was more liberal than the contracts or the law. Charles Babbage, in a widely circulated pamphlet published in 1826, criticizing the life insurance practice of the time, is an authority for the statement that most of the British companies were then willing to purchase their own policies at a price. Since policyholders were at that time considered to have no theoretical right to a surrender value the sums allowed in practice were doubtless of a speculative character and were not based on reserve shares. In a volume entitled *The Story of Life Insurance* by B. J. Hendrick, 1893, an account is given of a visit to London in 1844 by Elizur Wright, afterward Insurance Commissioner of Massachusetts from 1858 to 1866, on which occasion Mr. Wright witnessed a periodical sale at which policies on old and broken-down men were auctioned to speculators. In *J.I.A.*, XXI, page 337, is given a list of similar transactions at public auction about 1878, showing that while the auction price exceeded the office surrender values, the market values paid were generally very small percentages of the reserve value. Some of the cases, however, indicate that the life insured was probably seriously impaired as the policies brought relatively large market values.

In this country the history of non-forfeiture was very similar to that in Great Britain up to about 1860. Total forfeiture was the general rule, but if a policyholder came in before lapse he could generally make some bargain for a cash surrender value and especially so if he could show that he was not in good health. It is pertinent to the subject, however, that in 1860 the total amount of insurance in force in this country did not exceed two hundred million dollars.

According to the semi-centennial history of the New York Life (1895), that company wrote on August 13, 1860, the first policy form issued in this country containing a provision for a withdrawal equity. This benefit was in the form of a fractional amount of paid-up insurance and was limited to policies on the ten payment life plan. A similar practice was soon adopted by other companies.

In 1859 Elizur Wright, as Insurance Commissioner of Massachusetts, started an effective agitation in the interest of a general non-forfeiture law in that state and on April 10, 1861, the legislature passed the first non-forfeiture law, thus giving legislative effect to the contention that the owner of the policy has an individual and determinable interest in the aggregate of policy reserves. Not only was this statute in conflict with conservative actuarial opinion but it involved a remarkable departure from practice in the then novel requirement of extended term insurance equivalent to four-fifths of the Actuaries' 4 per cent reserve. The benefit was, however, subject to the deduction of the unpaid annual premiums with 6 per cent interest in event of death during the term. This proviso made the non-forfeiture benefit a cross between the modern system of pure term extension and the privilege introduced to us from Australia known as the automatic premium loan system. The benefit was therefore "term extension" in name only and on the basis of four-fifths of the reserve more nearly approximated the results of an automatic loan feature without the privilege of resuming premium payments. The non-forfeiture law of 1861 applied to Massachusetts companies only.

On May 21, 1879, the legislature of New York enacted a law applying to domestic companies after January 1, 1880, under which the insured, unless the provisions of the act were specifically waived in his application, was entitled to surrender his policy within six months after lapse and obtain under reasonable conditions either a term extension or paid-up insurance equivalent to at least two-thirds of the standard (Am. Ex. $4\frac{1}{2}$ per cent) reserve. There was no provision for the deduction of unpaid premiums. This law was passed on the initiative of the New York companies and provided for values generally lower than were being granted by them. It has been described as an example of wise minimum legislation (W. D. Whiting in *Insurance, A Text Book*, 1898). We have yet to feel in full the evil effects of the American practice of legislation as to contract detail. For example, the American Experience table, an admittedly inaccurate reflection of American experience, has been so interwoven with our statutes that it seems impossible to substitute a better standard.

By the time the New York non-forfeiture law was passed in 1879 the policies of nearly all companies had been drawn to provide for paid-up insurance and in 1879 the Mutual Benefit adopted a system of automatic term extension values with the option of paid-up. These extension values were equivalent to the American Experience 4 per cent reserve converted at the company's published single premium rates and were subject to the deduction of unpaid premiums in case of death within three years. Most of the companies were now paying cash values on some basis but, with isolated exceptions such as the cash values promised under tontine policies at the end of the period, this form of withdrawal was not generally given by contract or in any state required by law.

In 1880 the Massachusetts legislature passed a new non-forfeiture law, also the result of agitation by Elizur Wright. Under the new law the term extension feature of the statute of 1861 was abandoned in favor of a paid-up benefit equivalent to the Actuaries' 4 per cent reserve less a surrender charge of 8 per cent of the "future yearly costs of insurance which by its terms said policy is exposed to pay in case of its continuance." It was Wright's theory that the charge should be a function of the insurance value instead of the reserve or "self-insurance." This theory was the subject of heated controversy for many years. (See Wright's *Valuation Tables*, 1871, and his *Savings Bank Life Insurance Tables*, 1872; "Insurance Values as Bases of Surrender Charges" by Sheppard Homans. *T.A.S.*, April, 1891, and October, 1896; also discussions by D. P, Fackler and W. D. Whiting in *Insurance, A Text Book*, 1898.) Wright's rule evidently assumed a permanent selection against the company. From a practical point of view it was open to the objection of being unintelligible. Nevertheless it continued the rule in Massachusetts until 1900, at which time the legislature adopted as a substitute a discontinuance charge of 5 per cent of the present value of future net premiums, a more intelligible if not less arbitrary and peculiar provision. The law of 1880 was also remarkable as containing the first statutory provision for a cash surrender value to be available upon surrender by the insured, his wife, and any beneficiary, provided, however, that the insured had no minor or dependent children.

The various amendments of the Massachusetts and New York laws and the non-forfeiture statutes of Michigan, 1869, California, 1869, Maine, 1877, Missouri, 1879, Kentucky, 1893, etc., are of no particular interest except as a basis for the generalization that the laws have commonly followed the practice of the companies very much as the Lex Mercatoria was derived from the customs established by practice among merchants. In a paper on "Liberality of Modern Policies," *T.A.S.*, October, 1911, Mr. Henry Moir said: "I cannot find that any real improvement or advance toward liberality claiming to be scientific or sound has ever been initiated through legislation." The process of crystallizing practice into statutes is further exemplified in the group of non-forfeiture provisions forming a part of the so-called Committee of Fifteen laws. This committee, composed of twelve state insurance commissioners and three attorneys-general, was appointed in 1906 by a conference called by President Roosevelt to draft a proposal for uniform insurance laws. While the code finally recommended by the committee was not adopted in its entirety by a single state it has nevertheless exercised considerable influence upon subsequent legislation. It required a stipulated form of insurance automatic on default and having a net value equivalent to the valuation reserve less a surrender charge not to exceed $25.00 per $1,000 of insurance. It also provided for a cash value on surrender within one month after default, subject, however, to a delay clause of six months by way of protection to the company in time of financial panic. The bill also provided for the tabulation of the non-forfeiture values in the policy.

Aside from the requirement of a table of values and the delay clause in connection with loans and cash values, the important feature of the Committee of Fifteen proposal was that a company might operate thereunder provided it secured to the owner of the policy "a stipulated form of insurance" in event of default, leaving it to the company to determine whether this should be paid-up or term extension. Legislation fixing the details of form without alternative must be regarded as unwise since even the best-qualified men in the business can hardly foresee the complications the future will create. Extended term insurance is theoretically indefensible. A practice that is unscientific and unsound, even though it may have worked under favoring conditions, should not be required by statute. Term extension gives the policyholder the right to demand of the company, or to enjoy automatically, without medical selection the conversion of his cash equity into the cheapest possible form of paid-up insurance under which, with negligible exceptions, the amount at risk increases as the policyholder grows older. A life insurance company expects and provides for the gradual impairment of its lives and ultimate death payment, but it does not expect that as the individual lives become impaired they will discontinue premium payments and at the same time increase the insurance risk. A contract or legal right to term extension permits this selection against the company while denying the company opportunity to provide for the expectation.

If human nature were always logical, if men were always in full possession of the facts and always acted or were able to act in accordance with the dictates of reason the extended term benefit would have resulted in disaster and been discontinued as unworkable long ago. Fortunately for the success of this system, men do not act with the certainty of logic but generally count neither the cost nor the profit if in conflict with their immediate needs or desires. The term extension plan has worked in practice partly for the psychological reasons indicated and partly because the values given by the American Experience table at the younger ages are relatively low. Mr. Arthur Hunter, in discussing the new American Men table (*T.A.S.*, May, 1919), has furnished an exhibit showing the net non-forfeiture values in terms of the new American Men table (ultimate). For example, under an Ordinary Life policy, age 25, 3 per cent basis, the term extension at the end of the fifth year under the old American Experience table would be 4 years, 214 days; whereas under the new ultimate table it would be 10 years, 138 days. The report of the Massachusetts Code Commission of 1906 said that the term extension feature of the law of 1861 resulted in injustice for the curious reason that the majority of the policyholders survived the period. It is evident that a fewer number would survive the period of term extension under the American Men table. Whether, with the astonishing growth of public knowledge of life insurance and the consequent opportunity to exercise intelligent selection, the future experience of insurance companies with the extension feature will be as satisfactory as in the past is a serious question.

The right of the insured to an "equitable interest" in the average or policy valuation reserve having been established by practice and statute, there remains to be considered the basis, amount, and duration of the withdrawal or surrender charge. The Massachusetts law of 1861 provided for a charge of 20 per cent of the reserve. The New York law of 1879 fixed the maximum charge at one-third of the valuation reserve. Others of the older laws limited the deduction to 25 per cent of the reserve, as for example, Maine, 1887, Michigan, 1869, Missouri, 1879, California, 1869. The Massachusetts law in effect from 1880 to 1900 (also the Kentucky statute of 1893) sought to get away from the reserve as the basis and provided for a charge equal to 8 per cent of the present value of all the future yearly insurance costs adjusted to the probabilities of survival. The Massachusetts statute of 1900 permits deduction of 5 per cent of the present value of the future net premiums. Taking, for example, an Ordinary Life policy issued at age 35 on the Actuaries' 4 per cent basis, the Massachusetts surrender charges per $1,000 are as follows for the years indicated:

YEAR	MASSACHUSETTS LAW OF 1880–1900		MASSACHUSETTS LAW OF 1900	
	8 Per Cent of Costs	Percentage of Reserve	5 Per Cent of Net Premiums	Percentage of Reserve
Third	17.57	49.4	16.42	46.1
Fifth	17.82	29.1	15.99	26.1
Tenth	18.51	13.9	14.76	11.1
Twentieth	19.43	6.4	11.90	3.9

Whatever one may think of Wright's solution of the problem of surrender charges no one has ever made a better statement of the equities involved in withdrawal values than is found in the following quotations from Wright's *Savings Bank Life Insurance Tables*, 1872:

> Hence it is very absurd to say a company can afford to release a healthy member from his contract whenever he pleases to retire and allow him to withdraw his self-insurance (reserve) fund without making any compensation to the company for its loss in the non-fulfillment of his contract.

On the other hand:

> To persuade a man to take a policy on the present terms with no rule of surrender that can be understood or stated in advance, it is necessary to work him up to such a pitch of enthusiasm or infatuation that he shall entirely overlook the fact that his circumstances may change and he may cease to need insurance before the term of his policy expires.
>
> The policies will be more persistent because everyone will know at the start what he is to expect and will know that the longer he stays in the less it will cost him to get out; whereas under the old system he soon learns that the longer he stays in the more it will cost him to get out.

The older legislative practice of fixing the maximum legal surrender charge at a percentage of the reserve was unsatisfactory because it resulted in an inadequate charge during the early policy years while permitting an excessive charge in later years. As pointed out, the Committee of Fifteen fixed the maximum surrender charge at \$25 per \$1,000 of insurance. Compared with the older limitation of 25 per cent, this rule evidently reduces the percentage rate after the policy has accumulated a reserve per \$1,000 exceeding \$100 but permits a heavier percentage charge during the earlier policy years where the necessity of such a charge is more apparent. The maximum of \$25 per \$1,000 has been adopted by most of the states, though in New Jersey the limit is \$30. In several states, including New York, the present limit is 20 per cent of the reserve or \$25, whichever is the greater. Louisiana with a limit of 20 per cent of the reserve adopted in 1906 is the only state now following the flat percentage rule. This exception is embarrassing to companies desiring to operate in Louisiana because of the small amount of the charge permitted under the ordinary life plan at the younger ages. The statutory provisions of the various states will indicate in a general way the opinion of legislators and supervising officials as to a fair surrender charge. It is not clear where the idea of \$25 per \$1,000 or 2½ per cent of the amount of the insurance as a fair maximum had its origin. As this charge is in excess of the deductions under Elizur Wright's system, the latter may have had some influence in the legislative determination of the maximum. Mr. H. W. St. John in *T.A.S.*, April, 1890, concludes that if seceding members are assumed to be in sound health the effect of withdrawals during the select period is to raise the rate of mortality almost precisely 2½ per cent. Others have reached a similar conclusion from this premise, but it is precisely the premise that is open to question.

While the existing statutes permit a surrender charge during the entire life of the policy no state requires a withdrawal value prior to the end of the third year. The Massachusetts Code Commission of 1906 expressed the opinion that it would be inequitable to require a surrender value before the third year under existing methods of agency compensation. As to the duration of the surrender charge it may be considered that for practical purposes the effects of the original medical selection have disappeared at the end of five years. W. D. Whiting (*Insurance, A Text Book*, 1898) observed that the self-selection by withdrawal is only a very mild counterpart of medical selection. Perhaps under normal conditions it does not exist at all. But assuming that it does exist, or may occur under abnormal conditions, we have here a basis for the common practice of limiting the deduction of a surrender charge to the early policy years.

It is the practice of some companies to grant the full policy reserve as early as the third year. Such companies allow no non-forfeiture value the second year. Evidently forfeiture of the entire reserve in event of withdrawal at the end of the second year, together with the dividend where forfeited through lapse, constitutes a substantial termination charge. This may in fact result in a larger aggregate of surrender charges than under the practice of allowing second year values with a moderate surrender charge covering a longer period. Strong arguments may be made for both points of view. In deciding which system to recommend the competitive position of the company should be considered. The company that thinks it has to pay maximum values to attract business may be the very company that should not agree to pay maximum values. Another company may safely offer maximum values precisely because it possesses other advantages to attract and hold business.

In addition to the forfeited reserves, the dividends, and surrender charges, it should also be kept in mind that the member who surrenders his policy also forfeits his insurance rights and, except in the case of non-participating insurance, his interest in the undivided surplus. These generally unconsidered forfeitures may go far toward reimbursing the company, particularly where the risk withdrawing is in an impaired condition.

The classic definition of a surrender charge is that of Elizur Wright in his *Savings Bank Life Insurance Tables* (1872), advanced in support of the system of surrender charges afterward incorporated in the Massachusetts law of 1880. Wright said that the charge should be a sum sufficient to procure a new insurance of equal value on a life equally good. What he actually did was to charge for the cost of securing a select life. Another and later view is that the charge should be at least sufficient to reduce the policy reserve used as the basis of the value to an amount not exceeding the asset share found by accumulating the premiums paid less all expenses and costs. Mr. J. F. Little, in a paper on "Modern Surrender Values," *T.A.S.*, October, 1912, would deduct from the asset share a factor covering the cost or risk of deterioration. He contends that the full valuation reserve should never be paid unless there is some other fund to the policyholder's credit sufficient to meet the cost of deterioration or unless there is reason to suppose that the vitality of withdrawals is not better than the average of those continuing. W. D. Whiting in *Insurance, A Text Book* said: "The surrender charge is a mere question of damages." Presumably he would have assented to the proposition that if there is no damage there should be no charge.

In a paper on "Surrender Values," *J.I.A.*, April, 1879, G. S. Crisford analyzes the several kinds of value a policy may have: for example, the reserve value; the asset share value; the true value if future experience were exactly known; the reinsurance value; the individual value taking into account the condition of the risk; and the market value as an investment. Crisford reached the conclusion that the reserve must be the basis of the surrender value and that the full reserve can never justly be allowed. This paper offers a basis for computing surrender charges to cover the effect of withdrawals on mortality, loss of contribution to expenses, loss on account of anticipated loadings and loss of expected profits in the case of stock companies.

A discussion of the subject of asset shares will be found in a paper by William Young, *T.A.S.*, October, 1910, on "Treatment of Cases of Alteration." The calculation of such shares will be found to throw light upon a variety of office problems as to the very existence of which the actuary may otherwise remain in ignorance. He will, however, be very fortunate if his computed asset shares for different plans and ages are found to be consistent with the system of withdrawal values that practical considerations have led the company to adopt.

The opinions quoted regarding the relation of asset shares to surrender values, in so far as they suggest that each policy should be made to pay its own way, raise a very far-reaching question under the existing system of agency compensation. Any answer will involve not only surrender values but policy valuations, premiums, and dividends. So long as the services of skilled salesmen are necessary a system of adequate compensation must be maintained. Whether the American method of paying a large first-year premium percentage commission is the best of possible practices need not be considered here.

How shall acquisition expenses be considered as chargeable? From one point of view it may be that the premiums and benefits, including surrender values, of the new member should be charged with the cost of securing his membership so that each policy shall appear to pay its own way. Effect has been given to this view by the various modifications of the older and unnecessarily severe system of full level net premium valuations. The view that each policy should pay its own way is in accord with the old law doctrine that where a party to a contract desires to cancel it he must put the other party in as good a position as if the contract were fully performed. This was precisely Elizur Wright's definition of a surrender charge.

In contrast with the asset share theory it may be contended with some force that the acquisition of new business by an established company is a business adventure on the part of the existing membership who expect to profit thereby and who should therefore provide the funds for the investment out of existing surplus. Elizur Wright remarked in 1872 that "the tariff of commissions can only be settled correctly when we have a correct appreciation of the value to the company of the business to be obtained by the payment of commissions." To this point of view statutory effect has been given by Section 97 of the laws of New York whereby first-year commissions and medical expenses are limited to the level premium loading plus the present value of the assumed select mortality savings. This theory of the matter is not in conflict with the fact that a policy of life insurance is an alternative or unilateral contract, subject to termination by the owner at any time. (See *New York Life* v. *Statham*, U.S. Reports 93; also "Modern Surrender Values" by J. F. Little, *T.A.S.*, October, 1912, and discussion, May, 1913.) Presumably the companies are responsible for the existing commission system. If they prefer to discount future expense contributions and pay heavy first-year commissions why should the termination equity of the individual policyholder suffer thereby?

The considerations necessary to justify any system of reasonable surrender charges may be summarized as follows:

Possible effect of withdrawal of healthy lives on mortality.

Failure of contributions towards refunding initial expenses.

Disturbance of existing investments and the cost of maintaining a cash fund for payment of surrender values.

An obstacle to withdrawal short of causing dissatisfaction and within reasonable limits of equity.

No one of these reasons is complete but each of them must enter more or less into the judgment of the actuary in guiding the practice of his company.

Certain sciences obtain light from a study of abnormal conditions. We may learn something from the experience of fraternal assessment organizations where the periodical charges for the insurance benefits approximated the yearly costs and where there were no reserves and hence no withdrawal values. It was noticed that as soon as the assessments began to increase the healthy lives dropped out in much larger proportion than the general average. This resulted in a deteriorating membership and necessitated increased assessments. Thus a vicious circle of cause and effect was established. It was formerly thought that the introduction of guaranteed cash surrender values in level premium policies would set in motion a similar process of selection against the company, especially in times of financial panic. That extreme view is of course no longer entertained. Experience has shown it to be groundless, at least so long as the insurance company retains public confidence in its financial soundness. A company in prosperous condition issuing a liberal contract comparing favorably in cost with its competitors should expect to find that its impaired risks are about as likely to succumb to the temptation of cash and loan values as its healthy members. Withdrawing members do not appear to give much attention to their physical condition. Pascal said: "We know so little of ourselves that many a one fancies he is dying when he is quite well and many others fancy they are quite well when death is nigh at hand." In this observation we find reason for the paradox that guaranteed cash and loan values, by offering a temptation to the impaired risk less often resisted than in the case of the healthy lives, operate under normal conditions to protect the company against adverse selection. In consequence of these psychological forces the mortality among withdrawing lives may conceivably prove to be higher than among the thrifty who continue their insurance free from indebtedness. The question as to whether under normal conditions withdrawals have an appreciable adverse effect on mortality is debatable. (See *Effects of Selection*, E. McClintock, 1892; "Modern Surrender Values,"

J. F. Little, *T.A.S.*, October, 1912, and discussion, May, 1913). If such an effect exists it seems likely that it will be more apparent in the case of non-participating business where the inducement to continuance is not in the later policy years quite so strong as under profit-sharing contracts. It should be kept in mind that it is not so much the number of withdrawals that is important but rather the difference, if any, in the quality of the lives withdrawing as compared with those who continue. The difficulty with the assessment system was that it offered no inducement to the impaired life to withdraw and no inducement to the healthy life to continue.

The real motives that lead to action are often subconscious, always mixed, and commonly considered of a private character. The underlying causes of surrenders are therefore difficult if not impossible to get at. Probably the proportion of natural-born lapsers in any group is relatively constant. A certain percentage of every group is lacking in continuity of purpose just as a certain percentage will be found to have red hair. It is easy to believe that this type will show a high rate of mortality. Those who have to deal with surrender transactions generally agree that the large majority of surrenders are the result of lack of funds, more or less habitual. Impecuniosity is an ailment more frequent among impaired lives than among vigorous lives.

We may summarize the foregoing as follows: It is possible as to any office that a condition may arise that will adversely affect the public credit of the company. Under the influence of fear and the raiding of "twisters" the proportion of healthy lives withdrawing may be largely increased. Such a process would certainly have an adverse effect on mortality. Although a situation of this character may never and probably will never occur in the history of any particular company yet the possibility exists. Consequently, life insurance companies are clearly justified in giving their persistent members the benefit of reasonable surrender charges against those who withdraw, as an offset to the possible deterioration of risks as well as for the other reasons mentioned.

DISCUSSION

L. A. Anderson: There is so much in this paper that I agree with and so little that I disagree with that it is very difficult to make up anything worth while in the way of discussion. I am sure, therefore, that an attempt to give an extended discussion would cause someone to spring that famous old German saying, "Viel Schrei und wenig Wolle."

The historical treatment is particularly valuable because it throws emphasis and in fact sheds a great deal of light upon the effort to find a basis for a surrender charge. In other words, it brings up the question that everyone has to face in tackling a new problem, namely, "How shall we go at it?" The author has referred to the following bases:

1. A flat percentage of the reserve.

2. A flat percentage of the present value of the future costs of insurance.

3. A flat or graduated percentage of the face of the policy, regardless of plan, age, or other facts except duration.

If I were to endeavor to be critical I would say there are a few points where the thought is not quite clear, but this I take it is unavoidable in treating a subject of such magnitude in a short paper. Some of the questions must necessarily be treated so briefly as to leave more or less doubt regarding what the author intended to convey. In my opinion the subject is large enough for a much more extended treatment than is possible in a paper of this kind.

Without burdening you with any further preliminaries I wish to refer briefly to some of the points which appear to me to be somewhat obscure. On page 13, the author refers to the "best thought" of the time. The question arises as to who can say what the "best thought" is on any subject at any particular time. All authorities usually claim that their thought on the subject is the "best thought." What the author means to say, perhaps, is that the most prominent men of the profession were of such and such opinion.

On page 14 the author refers to the Massachussetts non-forfeiture law of 1861 as being very liberal and furnishing an excellent argument in competition, but he says: "It has been advanced as a reason for the relatively slow growth of Massachusetts companies."

I am not sure that the author intends to convey the idea that this non-forfeiture law is in any way responsible for the relatively slow growth of the Massachusetts companies, but he leaves the statement without challenge or explanation, and I fear that the statement as it stands may be read as being approved by the author. I wish, therefore, to point out some of the reasons that occur to me why the growth of the Massachusetts companies has been relatively slow.

It is a well-known fact that institutions located in larger centers have a tendency to grow in proportion with their surroundings, and since New York outstripped all other centers at an early date it is only natural that business should be drawn in that direction. The Massachusetts companies outside of the city of Boston are as a rule located in comparatively small cities. While this is not altogether a determining factor, it undoubtedly had a strong influence on the growth of the companies. Then, too, the companies of Massachusetts have always been managed, I would say, by relatively conservative men. They have advanced cautiously and have thought of safety first. I am inclined to believe that if a McCall, McCurdy, Hyde, Hegeman, or Dryden, with their associates, had been managing one of the Massachusetts companies, that company would have outstripped many of its competitors in size. I say this without any reflection on these men as far as safety is concerned.

On page 16 the author quotes from Henry Moir in *T.A.S.*, October, 1911, as follows: "I cannot find that any real improvement or advancement towards liberality claiming to be scientific or sound has ever been initiated through legislation." I believe the bare statement as it stands is correct, nevertheless the author points out that Elizur Wright was the first one to agitate the question of surrender values and to secure the passage of the first law on the subject, and that his agitation antedated the issuance of the policies with surrender values by at least one year. It is to be noted also that the policies containing surrender values that were issued prior to the enactment of the first law on the subject were of a class that would make forfeiture of values the most striking in case of failure to pay premiums.

On page 18 the author speaks of the "astonishing growth of public knowledge of life insurance and the consequent opportunity to exercise intelligent selection," etc.

This is the first time that I have found anyone who would express himself as being astonished at the growth of public knowledge of life insurance. I would rather say the astonishing ignorance on the part of the public with respect to life insurance generally and particularly in respect to their own best interest. I question if that growth of knowledge on the part of the public has even kept pace with what I would call the astonishing growth of the life insurance business.

On the same page (18), the author speaks of the right of the insured to an equitable interest in "average of policy valuation reserve." I fail to see the point to the "average of policy valuation reserve," because surely no one would have the audacity to say that each member of a company should be entitled to the same amount regardless of plan or duration. In other words, it is not clear to me what the word average refers to. The thought that comes to my mind is the average reserve per thousand or per member in a company regardless of age, plan, or duration. If surrender values are allowed at all it certainly must be based on some more equitable basis than that. On page 25, the author speaks of causes that lead to surrender or lapse, and says, "The underlying cause of surrender is therefore difficult if not impossible to get at."

I believe that it is quite safe to make the generalization that surrenders are due in large measure to improvidence on the part of policyholders, and I believe it has been established beyond a doubt that the mortality among the improvident or "ne'er-do-well" is higher than among the thrifty and "well-to-do," although we find another unfavorable class among the very wealthy.

I am just a little disappointed to find that the author did not make use of the investigation conducted by one of his predecessors in office, which showed a condition very similar to the recalescence of metals.

The New York law, for example, was framed on the theory that the first-year mortality would be approximately 50 per cent of the expected, and that during the first five years the mortality would rise gradually until the curve of each age group of new risks would join the ultimate curve at the end of five years. Mr. Loveland's investigation indicated that the mortality of each separate group actually rose above the ultimate curve in about the sixth or seventh years and then receded to join the ultimate curve. This peculiar recalescence or receding after having arrived at and exceeded the ultimate curve was undoubtedly due to the fact that during those policy years the thriftless would take their cash and withdraw, and that instead of making adverse selection it actually produced a selection in favor of the company.

I have read a great deal and heard a great deal of discussion on the question of adverse selection, especially in connection with the subject of extended insurance, that it leaves room for a person afflicted with an incurable disease, for example, to let his policy lapse into extended insurance on the theory that it will undoubtedly last long enough to cover him the rest of his life. I have yet to find a single case substantiated by evidence where a policyholder deliberately lapsed his policy with any such end in view. On the contrary I have known of cases where people have literally "scratched and scraped" to raise the money so as to pay the premiums when due because the policyholder was in poor health. In other words, when the assured is afflicted with an incurable disease he would take no chances but would see that the premiums are paid. I believe this would be a very interesting subject for investigation, but until I am furnished with positive proof I shall prefer to believe that the psychological force, so to speak, will outweigh the temptation which we must grant might be there, and which might easily be taken advantage of if people were fully informed about their policy, and if furthermore they were ready to admit that their lives might soon be terminated.

On page 24, the author says, "In consequence of these psychological forces the mortality among withdrawing lives may conceivably prove to be higher than among the thrifty who continue their insurance free from all indebtedness."

It will be observed that the author says, "*May conceivably prove to be higher*," etc. I believe this has been proved beyond a doubt.

The mortality experience on extended insurance is undoubtedly higher because this feature has been automatic and consequently has been unconsciously taken advantage of by an unusually large number of the thriftless, among whom the mortality is always high.

The author has treated the subject entirely from the standpoint of old line companies. I wish, therefore, to refer briefly to the fact that the same problem has been agitated and is being agitated among fraternal societies, and this has resulted in some rather peculiar forms of legislation. For example, in the Mobile Bill it was provided that societies which base their premium rates and reserves on the National Fraternal Congress Table of Mortality shall not be allowed to grant surrender values in any form. This was adopted in many states. It was also provided in the Mobile Bill that societies which base their rates on the American Table and 4 per cent interest or some higher standard shall be allowed to grant surrender values. One state, Wisconsin, requires the societies to grant surrender equities no matter what table is used, if they provide for collection of level premiums for whole life or other forms of insurance.

The provision that societies using the N.F.C. Table should not grant surrender values and that societies using the American or higher standard should be allowed to grant such values was based on the theory that the N.F.C. Table did not provide adequate reserves for such values, and that the policyholder or member received the equivalent of surrender values in the reduction of premium. The fallacy of that theory is clearly brought out by the fact that in many cases the reserves under the N.F.C. Table are actually higher than the reserves on similar policies under the American Table. Mr. C. F. Iliff, actuary of the Supreme Tribe of Ben Hur, has published a table and an illustrative chart showing how, for example, at age 35, on an ordinary life policy the reserve is higher on the N.F.C. Table than the reserve on the American 4 per cent Table up to about the seventeenth year. From the seventeenth year to about the thirty-eighth or thirty-ninth year the reserve on the American Table is higher. From then on for about seven or eight years the N.F.C. Table is higher, and after that the reserve on the American is higher, showing that the curves of the two reserves would literally intertwine (see *Proceedings of Fraternal Actuarial Association*, No. 3, pp. 28 to 36.).

Let me refer also to the fact that one large society adopted a mortality table based on its own experience, including a lapse factor, and worked out an elaborate scheme by which the policyholder would receive a reduction in premium which was mathematically equivalent to the surrender values. I shall not go into an extended discussion of that plan, but it is an interesting fact that recently the society has commenced to issue certificates of various forms with full surrender values.

Mr. J. C. Harvey: Mr. Evans quotes from *New York Life* vs. *Statham*, U.S. Reports, Vol. 93. That opinion is particularly interesting and valuable, in that Justice Bradley was formerly an actuary of prominence. I think he was actuary of the Mutual Benefit. In the opinion he refutes the false doctrine that something can be accumulated out of nothing.

The decisions in the Roth case, 122 Fed. 853, now frequently quoted, and the Westerman case, 196 Mo. 670, are undoubtedly based on the Statham case.

I want to call your attention to sections 6151 and 6153, Article II of the Missouri Non-forfeiture Law, originally passed in 1879, and practically unchanged since that time except as to the reserve standard, under which a company is allowed to deduct 25 per cent from the reserve as a surrender charge, requiring the balance to be applied to the purchase of extended insurance. The right is then given to deduct the forborne premiums at time of decease, but not in excess of the ordinary life premium. The latter provision is still on the books and I think if a company contracts to do more than the statute demands and makes no provision for deducting forborne premiums, it nevertheless appears to retain the right to do so.

To comply with the laws of Missouri and at the same time with those of other states, a deduction from the reserve of a surrender charge of 25 per cent, or $25 per $1,000 of insurance, whichever is the smaller, is the maximum permitted before purchasing extended insurance. The only way to get away from extended insurance is to make a policy provision for unconditional paid-up insurance, the value of which is at least 75 per cent of the reserve.

Mr. E. E. Cammack: I have not prepared a written discussion. I got the paper only the other day.

Mr. Evans has made some quite alarming remarks about what the effects of selection in regard to extended insurance would be if policyholders were well informed about the value of the privilege. I cannot quite agree with him. I do not think there is any cause for alarm.

I think the man with a slight impairment would be the last man in the world to take extended insurance. He would not take a chance. He might not die in time and then he would lose the protection he would have had if he had continued payment of premiums.

As for the man who is practically certain to die within the extended term, there may be some selection against the insurance company, and by reason of this our mortality experience under extended term may be very heavy. But it must not be overlooked that the loss involved is more apparent than real. This is so because those policyholders who exercise selection against the company and die within the extended term would, if they had continued payment of premiums, have given rise to claims under premium paying policies. The heavy mortality under extended term arising from selection is offset by a corresponding reduction in the mortality under premium paying policies. The real loss to the insurance company is approximately the amount of the premiums that would have been paid if the extended insurance had not been taken.

Volumes have been written as to the selection that is exercised by the policyholder who surrenders his policy. Mr. Evans has discussed the theory that a surrender charge should be made on account of this selection. I do not think that in theory any surrender charge should be made even if it is admitted that all withdrawing policyholders are healthy lives. If the mortality table on which our premiums are calculated were based upon an experience under which there had been no withdrawals, then, assuming that only healthy lives withdrew, it would be correct to make a surrender charge. But the table on which we base our premiums is constructed upon an experience in which there were withdrawals, and, consequently, in an insurance company with a normal number of withdrawals the remaining body of policyholders should continue to experience the mortality rate of the mortality table upon which the premiums were based.

It seems to me that the only danger is in the case of a company that has fallen into ill repute and in which the surrenders are more than normal in number.

The theory that the surrender charge should be such that the company can recruit a new member to take the place of a withdrawing policyholder is really the same theory underlying the principle of basing the surrender value upon an asset share, and I believe this to be the correct theory. I think in fixing surrender values there should be borne in mind certain fundamental principles. First, they should be generally equitable and, second, the rule for determining them should be a simple one to apply.

It seems to me that the best plan is to construct a table of asset shares and then compare them roughly with reserves and make a small deduction from the reserve to approximate the asset share and so as to bring the surrender value a little below the asset share. This provides a source for a small profit from withdrawals and protection to a company should it encounter bad times or fall into disrepute.

MR. F. A. DRAPER: There was one remark made by Mr. Anderson that might be misunderstood to the effect that the valuation provision in the fraternal law contains anything about rates. All that is mentioned in that law is that it must accumulate the reserve required by the mortality table in use. Hence, the rates may be derived from some other mortality table, provided the reserve is the same or larger than would be derived from the American 4 per cent.

MR. L. A. ANDERSON: That is perfectly true as far as the valuation section is concerned. But in some states, at least, there is a section of the statutes that requires the collection of rates not lower than a certain minimum, at least so far as the admission and creation of new societies is concerned.

MR. C. H. BECKETT: As an interesting example of confirming the belief of those who hold that the selection of extended insurance is not likely to be adverse, I wish to announce the results of a recent mortality investigation extending over business of issues from 1896 to 1921, both inclusive. For the years 1908 to 1921, both inclusive, the experience on extended insurance, on policies, all of which contain the automatic provision for extended insurance, showed a percentage of mortality to expected 15 per cent lower than the average experience of that company over the same interval.

MR. L. M. CATHLES: I have considerable sympathy with Mr. Evans' position on extended insurance, though I am not willing to go as far as he does in holding it up as a bogey. The trouble really seems to be that we have been selling life insurance instead of death insurance, as a prominent lawyer once remarked to me at the trial of a case in the state of Missouri. He said if we had only started by calling this business of ours "death insurance" instead of "life insurance," 90 per cent of our troubles would not exist. But that is the condition which we face.

We have gone out and sold to the people life insurance. And it is only natural that courts and legislatures should think of it as insurance for the term of life, subject to some sort of change if the man fails to fulfil his part of the contract. And it is only natural, further, that courts and legislatures should make the results of a man's misfortune as light as possible to the man.

So that we are facing a condition and not a theory. We have sold life insurance and I am sure we are going to have to continue to extend that protection, as long as is possible, according to our usual calculations.

I have this suggestion to make to Mr. Evans: It might be possible to measure the disastrous effect of extended insurance by comparing what happens when the premium is automatically advanced by the company under the automatic premium loan provision with what happens when the policy is placed on extended insurance. There is, after all, not a great deal of difference between the term of extended insurance and the period for which the policy will be continued under the automatic premium loan privilege. Of course, under the latter the company deducts the premiums which have accrued.

Mr. George Graham: Personally I am glad that our forefathers made the mistake and called it "life insurance." I think I get a great deal more pleasure out of thinking of myself as being in the life insurance business than I would if I had to say I was in the death insurance business.

Mr. L. A. Anderson: May I just have a word? I wonder if our good friend, Mr. Cathles, really believed that a lawyer should get rid of 90 per cent of our ills by simply changing the names? If I were ill I would like to have a physician prescribe for me. I think it would take somebody better equipped than a lawyer to take care of 90 per cent of the ills of life insurance.

Mr. L. M. Cathles: My friend undoubtedly meant 90 per cent of our legal troubles.

Mr. James E. Flanigan: I think Mr. Evans throughout his paper has brought out the point that there had been a steady demand for larger surrender values from time to time until they had reached a maximum point. I would like to call attention or emphasize the point that in the last few years, since the world-war, I believe that life insurance has been sold in a great deal larger proportion of cases on the savings or the investment feature of it than ever before in its history. I think that the sale of the Liberty Bonds and the certificates during the war period left a field that was not only taken advantage of by the get-rich-quick fellows, but we found, at least in our own company, that the salesmen very readily took to that same line of talk for selling a larger amount of life insurance than they had in previous years.

MR. WENDELL P. COLER: I think that the different surrender values put different burdens on the company. I have always been of the opinion that the laws which compel us to make the same surrender charge for the different options offered to the withdrawing member were incorrect in principle.

The man taking a cash value and terminating his connection absolutely with the company should be considered in a different light from the man who takes paid-up or the man who takes extended. Examination of the published experience of different companies seems to show that the man who takes extended insurance puts the greatest burden on the company.

The experience given by Mr. Beckett was very interesting to me. I noticed, however, that all of the policies provided for automatic extended insurance. As I have noticed the development of the withdrawal benefits, it has seemed to me that the making of extended automatic was the one thing that made extended insurance possible.

I think some years ago there was in the *Transactions* a review of the experience of the Mutual Benefit. I may be wrong in the company but I think it was the Mutual Benefit. That experience brought out very clearly the point that under automatic extended insurance the cost to the company—perhaps I had better say, the selection against the company, was not as severe as when the paid-up feature was the automatic feature and extended was left to be selected by the withdrawing man.

MR. J. BURNETT GIBB: I get so few chances to come to your very valuable meetings that I would like to take this opportunity to say a word on the subject of surrender values, which is one in which my own company is interested because we have perhaps gone farther in the way of liberality than a great many, at least we started earlier, but several other companies have recently followed in that direction.

So far as our investigations go, we have not been able to discover that the giving of liberal values has tended toward selection against the company. Our experience rather indicates that by having large values we are able to give inducements toward the continuation of the policies and thereby increase our persistency and in that way we get away from adverse selection.

I was very much interested in Mr. Beckett's company's experience which would indicate that they have not had any adverse selection.

Another thing which of course is very important is that generally speaking the lives which enter at the older ages are less apt to discontinue their insurance. Now, if the lapse rate tends to be heavier among the younger ages of entry and we know that if the extended insurance values were based on what is more nearly a true table, for instance, the American-Canadian table, we would have to give very much longer extended insurance than we are giving under the American table, even when the full reserve is applied, and from that in itself it would seem to me that on the average we can feel that the length of extended insurance given by the various companies makes the whole proposition of extended insurance perfectly safe.

Mr. Marcus Gunn: I have been interested in a company that has had a unique experience in regard to extended insurance in that the extended insurance is such a large volume of its present insurance in force. It is a small company and has a residue of perhaps a maximum of ten millions of business. Practically one-third of the present insurance in force is on extended insurance, the total amount being $5,000,000 at a recent date. The company has profited from this extended insurance quite a great deal. The mortality has been very good.

Mr. Percy H. Evans: I appreciate the discussion of this paper. I have listened to some theories of anti-selection that surprised me. It seems to me that most of the criticisms were either just or debatable. In so far as they are just, I accept them with thanks. So far as they are debatable, I imagine that it will be unprofitable to go into them now except to say that the paper was written as nearly as possible from a non-partisan point of view. I think the text of the paper hardly justifies Mr. Cathles in saying that these comments make term extension a bogey. What I said was more in criticism of legislation that crystallizes into our statutes the requirement of a form of withdrawal which I believe is entirely unscientific, and I have yet to hear any dispute on that point.

I was very much interested in Mr. Beckett's experience. Our own experience under issues 1901–6 showed a term extension mortality of 103.6 per cent of the A.M. Select Table or about 25 per cent in excess of the general experience. Under these issues the paid-up was the automatic feature. A forthcoming count of the experience under extensions as the automatic feature is not yet available. Of course it is expected that the automatic extension will give better results.

Referring to Mr. Cammack's remarks about the use of asset shares, I fully appreciate what a smooth flowing theory you have when you discuss surrender values from that point of view, but I apprehend that the majority of the offices would find considerable difficulty when they came to work this problem out on an asset share basis. Under our system of compensation in this country, asset shares do not work out so that they fit in smoothly with our practice.

Mr. Beckett: I am tremendously interested in that difference which Mr. Evans suggests and yet I hesitate a little bit about asking Mr. Evans a question on that. I am only going to do so under this condition: that if for any reason you do not see fit to answer it, don't answer it. It is rather personal as regards your company. And that is, whether you think the unfavorable experience on extended insurance which your company has experienced is due in any substantial amount to a practice which is quite prevalent among some companies, particularly at the home office of those companies, that is, the granting to certain classes of risks, some of them underaverage, high premium policies, endowment policies, and the like. In our limited experience I found out by subdivision that in the few attempts to substandardize endowments some few years ago that was rather disastrous. But there is a tendency to offer high premium policies to underaverage cases in lieu of the policy they ask for. They, of course, make selection against the company in those cases. Of course, that would work out to a disadvantage to a considerable extent in calculating the total results of extended insurance.

MR. EVANS: It is quite possible some of that influence enters into our experience. We have had in our office for a great many years a theory, which I think is unquestionably fallacious, that you could protect the company in some cases by offering endowment policies. Offhand, I should hesitate to admit that there had been enough of that to materially affect the volume at risk under the term extension.

FUNDAMENTAL ANNUITIES FOR CALCULATING TOTAL AND PERMANENT DISABILITY RESERVES BASED ON HUNTER'S TABLES AND 3 PER CENT INTEREST

By J. P. BOWERMAN

It often happens, particularly in small companies, that reserves are needed on isolated cases of disability benefits, where such reserves could be found more quickly by the aid of the annuities hereafter described, than by making a complete set of reserve tables by the formulas and methods described by Mr. J. C. Rietz in Volume VI of the *Record*. The figures given herein will also be found very convenient when checking the accuracy of disability reserve tables computed by means of continued formulas. I have therefore calculated the values of

$$a^{ai}_{x}\,, \qquad \text{a}^{aa}_{x:\overline{n}} \qquad \text{and} \qquad a^{ai}_{x:\overline{n-1}}$$

based on Hunter's tables and 3 per cent interest. By means of these annuities and the formula that the present value of the benefit minus the present value of the future net premiums equals the reserve, the reserves for disability benefits may be easily found. The net premiums for disability benefits are also easily obtained. The values of

$$a^{ai}_{x:\overline{n-1}}$$

where n equals the duration in years, for ages 20 to 59, and durations from 1 to $(60-x)$ were obtained by formula (23) on page 219 of *T.A.S.A.*, Vol. XVII, and the work checked by an independent calculation for duration $(60-x)$ by the formula

$$a^{ai}_{x:\overline{n-1}|}=\frac{N^{ii}_{x}-N^{ii}_{x+n}-D^{ii}_{x}\,\text{a}^{i}_{x n}}{D^{aa}_{x}}$$

which is formula (18) on page 218 of Vol. XVII of *T.A.S.A.* or formula (40) in *Actuarial Studies*, No. 5. The largest discrepancy found for duration $(60-x)$ years by the independent check formula just mentioned was one cent and nine mills on an annuity of $100 per year for twenty-two years or nineteen cents on the same annuity for $1,000 a year for twenty-two years. The values for the durations between $(60-x)$ and $(75-x)$ were found by the independent check formula previously quoted. In using this formula, the values for $a^{i}_{x:\overline{n}|}$ were taken from pages 25–34 of the *Record* for June, 1917.

The reason I used the formula mentioned above for durations from 1 to $(60-x)$ years was because I was able to use the tables on pages 239 and 240 of Vol. XVII of the *T.A.S.A.* for said durations and for longer durations I had to use formula (40) in *Actuarial Studies*, No. 5, because the figures on said pages were only available for durations from 1 to $(60-x)$ years.

The tables have been computed on an eight-place millionaire by two different persons, and the results carefully compared, and I believe that the figures contained herein can be relied upon as being correct to the number of decimal places given. In the tables for $a^{aa}_{x:\overline{n}|}$ the symbols $\bar{5}$ indicates a number less than 5, and the symbol $\dot{5}$ a number greater than 5.

$$a^{aa}_{x:\overline{n|}}=\frac{N^{aa}_x-N^{aa}_{x+n}}{D^x_{aa}}$$

WHERE *n* EQUALS DURATION IN YEARS

Age	Duration in Years					
	1	2	3	4	5	6
20....	1.000000	1.963116̇	2.890679̄	3.783952̇	4.644166̄	5.472497̇
21....	1.000000	1.963085̇	2.890568̇	3.783725̇	4.643779̇	5.471910̄
22....	1.000000	1.963033̄	2.890424̇	3.783443̇	4.643316̄	5.471205̇
23....	1.000000	1.962991̇	2.890290̇	3.783170̇	4.642840̄	5.470475̇
24....	1.000000	1.962937̇	2.890132̇	3.782840̄	4.642283̇	5.469642̄
25....	1.000000	1.962882̄	2.889949̇	3.782472̄	4.641675̇	5.468724̇
26....	1.000000	1.962805̄	2.889733̄	3.782057̇	4.640987̇	5.467682̇
27....	1.000000	1.962737̇	2.889534̇	3.781647̄	4.640279̄	5.466614̄
28....	1.000000	1.962668̇	2.889310̇	3.781175̇	4.639493̇	5.465431̇
29....	1.000000	1.962576̄	2.889027̄	3.780629̇	4.638597̄	5.464102̇
30....	1.000000	1.962471̄	2.888738̇	3.780063̄	4.637663̄	5.462716̇
31....	1.000000	1.962385̇	2.888465̇	3.779506̄	4.636731̄	5.461324̄
32....	1.000000	1.962276̄	2.888143̄	3.778872̇	4.635694̇	5.459767̄
33....	1.000000	1.962164̄	2.887813̇	3.778226̄	4.634604̇	5.458124̇
34....	1.000000	1.962050̄	2.887477̄	3.777532̄	4.633436̇	5.456329̇
35....	1.000000	1.961933̄	2.887099̄	3.776766̄	4.632120̇	5.454321̄
36....	1.000000	1.961778̄	2.886652̇	3.775856̇	4.630594̇	5.452002̇
37....	1.000000	1.961631̄	2.886173̄	3.774879̇	4.628931̇	5.449485̇
38....	1.000000	1.961432̄	2.885597̇	3.773726̇	4.627021̄	5.446615̄
39....	1.000000	1.961239̇	2.884996̇	3.772521̄	4.624994̄	5.443560̇
40....	1.000000	1.961006̇	2.884319̇	3.771167̄	4.622741̄	5.440155̇
41....	1.000000	1.960778̄	2.883610̇	3.769738̇	4.620320̇	5.436485̄
42....	1.000000	1.960506̄	2.882809̄	3.768115̄	4.617598̄	5.432344̄
43....	1.000000	1.960226̇	2.881934̇	3.766346̇	4.614593̇	5.427743̄
44....	1.000000	1.959886̇	2.880932̇	3.764315̄	4.611148̄	5.422487̇
45....	1.000000	1.959536̇	2.879835̇	3.762058̄	4.607303̄	5.416577̇
46....	1.000000	1.959109̄	2.878535̄	3.759424̇	4.602826̇	5.409715̄
47....	1.000000	1.958626̄	2.877072̄	3.756432̇	4.597723̄	5.401897̇
48....	1.000000	1.958086̄	2.875399̇	3.752999̇	4.591882̇	5.392987̇
49....	1.000000	1.957444̇	2.873437̄	3.749019̇	4.585171̄	5.382817̄
50....	1.000000	1.956707̄	2.871206̇	3.744523̄	4.577622̇	5.371407̇
51....	1.000000	1.955883̇	2.868719̇	3.739519̄	4.569225̄	5.358692̇
52....	1.000000	1.954967̄	2.865956̇	3.733956̄	4.559860̄	5.344483̇
53....	1.000000	1.953949̇	2.862881̄	3.727732̇	4.549356̇	5.328541̄
54....	1.000000	1.952809̇	2.859410̇	3.720697̄	4.537496̄	5.310575̇
55....	1.000000	1.951503̇	2.855448̄	3.712701̇	4.524070̇	....
56....	1.000000	1.950017̇	2.850964̄	3.703687̄	....	....
57....	1.000000	1.948347̇	2.845934̇	....	....	....
58....	1.000000	1.946475̄	....	....	....	....
59....	1.000000	....	....	....	....	....

$a^{aa}_{x:n}$

WHERE *n* EQUALS DURATION IN YEARS

Age	Duration in Years					
	7	8	9	10	11	12
20....	6.27008$\dot{3}$	7.03800$\dot{2}$	7.77730$\dot{7}$	8.48901$\bar{3}$	9.17408$\dot{3}$	9.83344$\dot{3}$
21....	6.26923$\bar{8}$	7.03685$\dot{5}$	7.77581$\bar{7}$	8.48712$\dot{3}$	9.17173$\bar{5}$	9.83059$\bar{5}$
22....	6.26824$\dot{5}$	7.03553$\bar{1}$	7.77410$\dot{1}$	8.48495$\bar{4}$	9.16906$\dot{7}$	9.82737$\dot{3}$
23....	6.26721$\dot{4}$	7.03413$\dot{6}$	7.77227$\bar{6}$	8.48265$\dot{0}$	9.16622$\dot{6}$	9.82393$\dot{8}$
24....	6.26603$\bar{8}$	7.03254$\dot{5}$	7.77022$\bar{1}$	8.48006$\bar{8}$	9.16305$\dot{7}$	9.82012$\dot{6}$
25....	6.26473$\bar{4}$	7.03080$\bar{2}$	7.76797$\bar{1}$	8.47724$\bar{8}$	9.15960$\dot{7}$	9.81599$\dot{1}$
26....	6.26328$\dot{1}$	7.02886$\bar{7}$	7.76548$\dot{5}$	8.47414$\dot{9}$	9.15583$\bar{6}$	9.81146$\dot{7}$
27....	6.26177$\dot{5}$	7.02685$\dot{1}$	7.76289$\bar{2}$	8.47091$\bar{4}$	9.15187$\dot{3}$	9.80670$\bar{5}$
28....	6.26011$\dot{9}$	7.02464$\dot{8}$	7.76007$\dot{4}$	8.46739$\dot{0}$	9.14756$\bar{7}$	9.80151$\dot{0}$
29....	6.25827$\bar{9}$	7.02222$\bar{4}$	7.75696$\bar{9}$	8.46352$\dot{2}$	9.14282$\bar{5}$	9.79579$\dot{7}$
30....	6.25636$\bar{3}$	7.01967$\dot{4}$	7.75369$\bar{8}$	8.45941$\dot{1}$	9.137771	9.78967$\dot{8}$
31....	6.25439$\bar{9}$	7.01704$\bar{4}$	7.75027$\underline{\dot{5}}$	8.45508$\bar{6}$	9.13241$\dot{3}$	9.78317$\dot{4}$
32....	6.25222$\bar{0}$	7.01410$\dot{9}$	7.74646$\bar{8}$	8.45026$\dot{8}$	9.12646$\dot{4}$	9.77595$\dot{4}$
33....	6.24988$\bar{3}$	7.01095$\bar{2}$	7.74234$\bar{4}$	8.44504$\bar{9}$	9.12000$\dot{1}$	9.76810$\dot{8}$
34....	6.24732$\bar{7}$	7.00748$\dot{0}$	7.73781$\bar{9}$	8.43931$\bar{3}$	9.11290$\bar{6}$	9.75947$\bar{9}$
35....	6.24446$\dot{0}$	7.00360$\bar{9}$	7.73277$\underline{\dot{5}}$	8.43294$\bar{0}$	9.10501$\dot{8}$	9.74990$\bar{2}$
36....	6.24119$\bar{3}$	6.99921$\bar{5}$	7.72708$\bar{8}$	8.42576$\bar{3}$	9.09616$\dot{6}$	9.73915$\dot{6}$
37....	6.23763$\dot{2}$	6.99443$\bar{2}$	7.72087$\dot{3}$	8.41792$\bar{0}$	9.08646$\dot{3}$	9.72734$\bar{6}$
38....	6.23361$\bar{1}$	6.98903$\dot{7}$	7.71389$\dot{6}$	8.40911$\underline{5}$	9.07556$\dot{9}$	9.71409$\bar{0}$
39....	6.22929$\dot{1}$	6.98322$\bar{9}$	7.70633$\bar{6}$	8.39952$\bar{6}$	9.06366$\bar{1}$	9.69953$\bar{3}$
40....	6.22449$\bar{4}$	6.97676$\bar{0}$	7.69790$\dot{1}$	8.38881$\bar{7}$	9.05032$\dot{9}$	9.68320$\dot{3}$
41....	6.21927$\bar{5}$	6.96967$\dot{7}$	7.68862$\bar{8}$	8.37698$\dot{2}$	9.03553$\dot{5}$	9.66503$\dot{5}$
42....	6.21338$\bar{1}$	6.96168$\dot{1}$	7.67813$\bar{7}$	8.36357$\bar{5}$	9.01877$\bar{3}$	9.64446$\dot{5}$
43....	6.20681$\bar{4}$	6.95272$\bar{9}$	7.66635$\bar{1}$	8.34848$\dot{9}$	8.99990$\dot{9}$	9.62133$\bar{1}$
44....	6.19929$\bar{9}$	6.94248$\bar{0}$	7.65287$\bar{4}$	8.33127$\dot{6}$	8.97843$\bar{8}$	9.59505$\dot{9}$
45....	6.19081$\bar{6}$	6.93089$\dot{7}$	7.63765$\dot{0}$	8.31185$\bar{7}$	8.95424$\bar{7}$	9.56548$\underline{3}$
46....	6.18100$\bar{6}$	6.91756$\bar{3}$	7.62020$\bar{1}$	8.28968$\bar{1}$	8.92669$\bar{3}$	9.53186$\bar{6}$
47....	6.16985$\dot{7}$	6.90245$\dot{2}$	7.60047$\dot{5}$	8.26464$\bar{7}$	8.89562$\dot{1}$	9.49400$\bar{4}$
48....	6.15720$\bar{1}$	6.88535$\bar{1}$	7.57818$\dot{7}$	8.23639$\dot{4}$	8.86060$\dot{3}$	9.45140$\dot{1}$
49....	6.14282$\dot{1}$	6.86596$\dot{8}$	7.55297$\dot{0}$	8.20448$\bar{7}$	8.82113$\bar{1}$	....
50....	6.12669$\dot{6}$	6.84423$\bar{4}$	7.52470$\dot{8}$	8.16876$\bar{1}$	....	....
51....	6.10870$\dot{0}$	6.81996$\dot{8}$	7.49316$\bar{6}$	....	....	....
52....	6.08857$\bar{9}$	6.79284$\dot{6}$	....	....	....	....
53....	6.06601$\dot{9}$	....	....	....	....	....

$$\mathrm{a}^{aa}_{x:\overline{n}|}$$

WHERE *n* EQUALS DURATION IN YEARS

Age	Duration in Years					
	13	14	15	16	17	18
20....	10.46800$\bar{2}$	11.07862$\bar{2}$	11.66613$\bar{9}$	12.23135$\bar{9}$	12.77506$\dot{2}$	13.29798$\dot{4}$
21....	10.46459$\dot{9}$	11.07461$\bar{6}$	11.66148$\bar{2}$	12.22600$\bar{8}$	12.76895$\bar{6}$	13.29107$\bar{2}$
22....	10.46077$\bar{2}$	11.07013$\dot{2}$	11.65629$\bar{6}$	12.22005$\dot{5}$	12.76218$\dot{3}$	13.28340$\dot{2}$
23....	10.45669$\dot{0}$	11.06535$\bar{5}$	11.65075$\bar{5}$	12.21369$\dot{3}$	12.75492$\dot{0}$	13.27516$\bar{9}$
24....	10.45218$\dot{3}$	11.06008$\bar{1}$	11.64465$\dot{4}$	12.20668$\dot{1}$	12.74692$\dot{4}$	13.26610$\bar{1}$
25....	10.44728$\bar{7}$	11.05436$\bar{0}$	11.63801$\dot{9}$	12.19905$\dot{5}$	12.73821$\bar{5}$	13.25622$\bar{7}$
26....	10.44194$\bar{2}$	11.04810$\bar{1}$	11.63076$\bar{4}$	12.19070$\dot{7}$	12.72868$\bar{8}$	13.24542$\dot{1}$
27....	10.43628$\bar{1}$	11.04145$\bar{4}$	11.62302$\bar{9}$	12.18179$\bar{3}$	12.71848$\bar{9}$	13.23383$\bar{9}$
28....	10.43010$\dot{6}$	11.03419$\bar{1}$	11.61458$\bar{2}$	12.17205$\bar{1}$	12.70734$\dot{7}$	13.22117$\bar{1}$
29....	10.42330$\bar{8}$	11.02620$\bar{6}$	11.60529$\bar{3}$	12.16134$\dot{7}$	12.69509$\bar{7}$	13.20724$\dot{8}$
30....	10.41601$\dot{6}$	11.01761$\bar{8}$	11.59529$\dot{1}$	12.14979$\dot{2}$	12.68185$\bar{6}$	13.19216$\bar{3}$
31....	10.40823$\bar{4}$	11.00843$\dot{2}$	11.58455$\bar{5}$	12.13736$\dot{5}$	12.66757$\dot{0}$	13.17583$\dot{8}$
32....	10.39961$\bar{2}$	10.99825$\dot{2}$	11.57266$\bar{9}$	12.12359$\bar{7}$	12.65173$\bar{1}$	13.15772$\dot{8}$
33....	10.39021$\dot{7}$	10.98715$\dot{3}$	11.55967$\dot{9}$	12.10851$\bar{8}$	12.63435$\dot{2}$	13.13780$\dot{9}$
34....	10.37988$\bar{9}$	10.97492$\bar{9}$	11.54535$\dot{0}$	12.09186$\dot{2}$	12.61511$\dot{7}$	13.11571$\dot{9}$
35....	10.36841$\dot{5}$	10.96133$\bar{8}$	11.52940$\bar{9}$	12.07330$\bar{5}$	12.59365$\bar{4}$	13.09104$\bar{7}$
36....	10.35554$\dot{3}$	10.94609$\bar{5}$	11.51151$\bar{5}$	12.05245$\bar{6}$	12.56953$\dot{2}$	13.06332$\bar{3}$
37....	10.34136$\bar{7}$	10.92925$\dot{7}$	11.49169$\dot{6}$	12.02932$\dot{2}$	12.54273$\bar{7}$	13.03250$\dot{8}$
38....	10.32543$\dot{7}$	10.91031$\bar{8}$	11.46939$\bar{5}$	12.00329$\bar{5}$	12.51260$\dot{8}$	12.99788$\dot{6}$
39....	10.30787$\bar{6}$	10.88938$\bar{1}$	11.44469$\bar{8}$	11.97444$\dot{3}$	12.47918$\dot{9}$	12.95945$\dot{6}$
40....	10.28815$\dot{6}$	10.86586$\dot{6}$	11.41697$\dot{2}$	11.94207$\dot{1}$	12.44170$\bar{5}$	12.91636$\dot{5}$
41....	10.26618$\bar{7}$	10.83965$\bar{5}$	11.38606$\dot{0}$	11.90596$\bar{7}$	12.39988$\dot{7}$	12.86829$\dot{5}$
42....	10.24134$\dot{4}$	10.81005$\dot{6}$	11.35118$\dot{7}$	11.86527$\dot{1}$	12.35280$\dot{1}$	12.81423$\bar{6}$
43....	10.21342$\bar{7}$	10.77680$\dot{8}$	11.31203$\dot{0}$	11.81960$\dot{6}$	12.30001$\bar{5}$	....
44....	10.18177$\bar{7}$	10.73916$\dot{8}$	11.26776$\dot{9}$	11.76807$\bar{7}$	....	....
45....	10.14616$\bar{8}$	10.69685$\bar{9}$	11.21807$\dot{4}$	....	....	....
46....	10.10578$\bar{0}$	10.64897$\bar{5}$	....	....	....	....
47....	10.06035$\dot{8}$	....	....	....	....	....

$$a^{aa}_{x:\overline{n}|}$$

WHERE n EQUALS DURATION IN YEARS

Age	Duration in Years					
	19	20	21	22	23	24
20....	$13.80084\dot{2}$	$14.28430\bar{6}$	$14.74903\bar{0}$	$15.19563\dot{2}$	$15.62471\dot{8}$	$16.03685\bar{8}$
21....	$13.79305\dot{0}$	$14.27557\bar{2}$	$14.73927\bar{8}$	$15.18479\dot{6}$	$15.61271\bar{9}$	$16.02362\bar{2}$
22....	$13.78441\bar{9}$	$14.26589\dot{8}$	$14.72849\dot{3}$	$15.17281\dot{8}$	$15.59947\dot{1}$	$16.00900\dot{9}$
23....	$13.77513\dot{1}$	$14.25548\dot{3}$	$14.71686\bar{5}$	$15.15989\bar{5}$	$15.58515\bar{4}$	$15.99320\bar{5}$
24....	$13.76491\bar{4}$	$14.24402\bar{7}$	$14.70408\dot{3}$	$15.14568\bar{6}$	$15.56941\bar{9}$	$15.97582\bar{5}$
25....	$13.75378\dot{0}$	$14.23154\dot{4}$	$14.69014\bar{4}$	$15.13018\dot{6}$	$15.55223\dot{4}$	$15.95682\bar{1}$
26....	$13.74160\bar{3}$	$14.21788\dot{0}$	$14.67488\bar{6}$	$15.11320\dot{3}$	$15.53338\dot{6}$	$15.93595\dot{7}$
27....	$13.72851\bar{6}$	$14.20317\dot{6}$	$14.65842\dot{7}$	$15.09484\bar{3}$	$15.51296\dot{6}$	$15.91329\bar{6}$
28....	$13.71420\bar{3}$	$14.18707\dot{4}$	$14.64038\bar{1}$	$15.07468\bar{8}$	$15.49051\dot{2}$	$15.88833\dot{4}$
29....	$13.69845\dot{7}$	$14.16934\bar{3}$	$14.62049\dot{1}$	$15.05244\dot{1}$	$15.46569\dot{0}$	$15.86070\dot{8}$
30....	$13.68135\bar{6}$	$14.15004\bar{5}$	$14.59878\dot{8}$	$15.02810\dot{4}$	$15.43848\dot{0}$	$15.83037\dot{5}$
31....	$13.66280\dot{3}$	$14.12904\dot{4}$	$14.57510\bar{1}$	$15.00147\dot{8}$	$15.40865\dot{4}$	$15.79708\bar{0}$
32....	$13.64219\bar{3}$	$14.10568\dot{3}$	$14.54872\bar{6}$	$14.97181\dot{6}$	$15.37542\dot{3}$	$15.75998\bar{4}$
33....	$13.61947\dot{0}$	$14.07988\dot{1}$	$14.51955\bar{9}$	$14.93898\dot{8}$	$15.33862\dot{5}$	$15.71888\bar{1}$
34....	$13.59423\dot{5}$	$14.05120\bar{3}$	$14.48712\dot{6}$	$14.90247\dot{8}$	$15.29768\bar{7}$	$15.67314\dot{2}$
35....	$13.56604\dot{0}$	$14.01916\bar{0}$	$14.45089\dot{6}$	$14.86169\bar{5}$	$15.25196\bar{1}$	$15.62206\dot{8}$
36....	$13.53437\dot{4}$	$13.98319\dot{6}$	$14.41025\bar{2}$	$14.81596\bar{2}$	$15.20071\bar{6}$	$15.56487\bar{6}$
37....	$13.49916\bar{7}$	$13.94319\dot{4}$	$14.36502\bar{8}$	$14.76507\dot{2}$	$15.14370\bar{5}$	....
38....	$13.45963\bar{1}$	$13.89829\dot{5}$	$14.31430\dot{2}$	$14.70804\bar{2}$	....	....
39....	$13.41571\dot{8}$	$13.84841\dot{3}$	$14.25794\dot{8}$	....	....	....
40....	$13.36650\bar{8}$	$13.79255\bar{7}$	....	....	....	....
41....	$13.31163\bar{2}$	....	....	....	....	....

$$a^{aa}_{x:\overline{n}|}$$

WHERE n EQUALS DURATION IN YEARS

Age	Duration in Years					
	25	26	27	28	29	30
20....	16.43260$\bar{5}$	16.81247$\dot{7}$	17.17697$\dot{8}$	17.52657$\dot{4}$	17.86170$\bar{6}$	18.18279$\dot{1}$
21....	16.41804$\bar{2}$	16.79650$\dot{2}$	17.15948$\bar{7}$	17.50745$\bar{3}$	17.84083$\dot{4}$	18.16002$\bar{9}$
22....	16.40197$\bar{6}$	16.77887$\bar{3}$	17.14017$\bar{7}$	17.48633$\bar{7}$	17.81776$\dot{5}$	18.13484$\dot{5}$
23....	16.38457$\dot{0}$	16.75974$\bar{3}$	17.11919$\bar{1}$	17.46334$\dot{2}$	17.79259$\bar{4}$	18.10732$\bar{0}$
24....	16.36541$\dot{6}$	16.738678	17.09605$\bar{6}$	17.43796$\dot{1}$	17.76478$\bar{3}$	18.07688$\dot{6}$
25....	16.34445$\bar{0}$	16.71558$\dot{2}$	17.07064$\dot{7}$	17.41004$\dot{8}$	17.73416$\dot{4}$	18.04335$\bar{5}$
26....	16.32139$\bar{7}$	16.69014$\dot{9}$	17.04263$\dot{3}$	17.37924$\bar{4}$	17.70035$\dot{3}$	18.00630$\dot{9}$
27....	16.29629$\bar{4}$	16.66239$\dot{5}$	17.01201$\bar{0}$	17.34552$\dot{4}$	17.66330$\dot{0}$	17.96566$\bar{5}$
28....	16.26860$\dot{5}$	16.63175$\bar{2}$	16.97817$\bar{5}$	17.30825$\bar{0}$	17.62231$\dot{7}$	17.92068$\dot{7}$
29....	16.23793$\bar{7}$	16.59779$\dot{4}$	16.94066$\dot{9}$	17.26691$\dot{6}$	17.57685$\dot{6}$	17.87078$\dot{7}$
30....	16.20422$\dot{3}$	16.56042$\dot{9}$	16.89936$\dot{0}$	17.22135$\bar{1}$	17.52670$\dot{9}$	17.81572$\bar{4}$
31....	16.16717$\dot{5}$	16.51932$\dot{2}$	16.85386$\bar{8}$	17.17113$\dot{3}$	17.47141$\dot{7}$	....
32....	16.12589$\bar{5}$	16.47351$\bar{6}$	16.80318$\bar{2}$	17.11520$\dot{2}$	....	....
33....	16.08013$\bar{0}$	16.42272$\bar{0}$	16.74697$\dot{2}$	....	....	....
34....	16.02920$\bar{4}$	16.36620$\bar{8}$	....	....	....	....
35....	15.97236$\dot{6}$	....	....	....	....	....

Age	Duration in Years					
	31	32	33	34	35	36
20....	18.49021$\dot{2}$	18.78432$\bar{4}$	19.06546$\dot{0}$	19.33393$\bar{6}$	19.59004$\dot{8}$	19.83407$\dot{4}$
21....	18.46540$\bar{4}$	18.75730$\bar{7}$	19.03606$\dot{4}$	19.30198$\bar{5}$	19.55535$\dot{6}$	19.79644$\dot{0}$
22....	18.43793$\bar{7}$	18.72737$\dot{9}$	19.00349$\dot{2}$	19.26657$\dot{5}$	19.51690$\bar{0}$	19.75471$\dot{2}$
23....	18.40787$\bar{3}$	18.69458$\bar{5}$	18.96776$\bar{7}$	19.22770$\dot{0}$	19.47464$\bar{2}$	19.70882$\dot{8}$
24....	18.37461$\dot{7}$	18.658298	18.92822$\dot{1}$	19.18465$\dot{3}$	19.42784$\bar{0}$	19.65800$\dot{9}$
25....	18.33795$\dot{4}$	18.61826$\bar{7}$	18.88456$\bar{9}$	19.13711$\dot{5}$	19.37614$\bar{4}$	....
26....	18.29742$\dot{7}$	18.57399$\dot{4}$	18.83627$\dot{6}$	19.08451$\dot{9}$	....	....
27....	18.25291$\dot{6}$	18.52533$\bar{1}$	18.78316$\bar{4}$	....	....	....
28....	18.20364$\dot{5}$	18.47145$\bar{8}$	....	....	....	....
29....	18.14898$\dot{5}$	....	....	....	....	....

Age	Duration in Years					
	37	38	39	40		
20....	20.06626$\bar{6}$	20.28685$\dot{2}$	20.49604$\dot{4}$	20.69403$\dot{9}$	....	....
21....	20.02547$\bar{4}$	20.24267$\dot{7}$	20.44825$\dot{5}$	....	....	....
22....	19.98024$\dot{1}$	20.19369$\bar{9}$	....	....	....	....
23....	19.93047$\dot{9}$	....	....	....	....	....

$$a^{ai}_{x:\overline{n-1}|}=\frac{N^{ii}_x-N^{ii}_{x+n}-D^{ii}_x\mathrm{a}^i_{x:\overline{n}|}}{D^{aa}_x}$$

WHERE n EQUALS DURATION IN YEARS

Age	Duration in Years								
	1	2	3	4	5	6	7	8	9
20	.00000	.00050	.00138	.00254	.00393	.00550	.00722	.00906	.01101
21	.00000	.00050	.00138	.00256	.00398	.00559	.00736	.00927	.01130
22	.00000	.00051	.00140	.00260	.00405	.00570	.00752	.00950	.01161
23	.00000	.00051	.00141	.00263	.00411	.00580	.00768	.00973	.01192
24	.00000	.00051	.00142	.00266	.00417	.00591	.00785	.00997	.01225
25	.00000	.00051	.00144	.00270	.00425	.00604	.00805	.01025	.01261
26	.00000	.00052	.00146	.00275	.00434	.00619	.00826	.01053	.01298
27	.00000	.00052	.00148	.00280	.00443	.00633	.00847	.01082	.01335
28	.00000	.00053	.00150	.00285	.00452	.00648	.00869	.01112	.01374
29	.00000	.00054	.00153	.00291	.00463	.00664	.00891	.01142	.01414
30	.00000	.00055	.00156	.00297	.00473	.00680	.00915	.01175	.01457
31	.00000	.00055	.00158	.00303	.00485	.00699	.00942	.01212	.01506
32	.00000	.00057	.00163	.00312	.00500	.00722	.00975	.01256	.01563
33	.00000	.00058	.00167	.00321	.00516	.00747	.01011	.01305	.01628
34	.00000	.00060	.00173	.00334	.00536	.00778	.01054	.01364	.01705
35	.00000	.00062	.00180	.00348	.00560	.00814	.01105	.01432	.01792
36	.00000	.00065	.00188	.00364	.00588	.00856	.01164	.01510	.01892
37	.00000	.00068	.00198	.00383	.00620	.00903	.01230	.01598	.02002
38	.00000	.00072	.00209	.00405	.00656	.00957	.01304	.01694	.02124
39	.00000	.00076	.00221	.00430	.00696	.01016	.01385	.01800	.02258
40	.00000	.00081	.00235	.00457	.00740	.01080	.01473	.01915	.02404
41	.00000	.00086	.00250	.00486	.00788	.01151	.01570	.02042	.02564
42	.00000	.00092	.00267	.00518	.00840	.01227	.01675	.02180	.02740
43	.00000	.00098	.00285	.00553	.00897	.01311	.01791	.02333	.02934
44	.00000	.00104	.00304	.00592	.00960	.01405	.01920	.02503	.03150
45	.00000	.00112	.00326	.00634	.01030	.01508	.02063	.02691	.03390
46	.00000	.00120	.00350	.00682	.01109	.01624	.02224	.02903	.03658
47	.00000	.00129	.00377	.00736	.01197	.01754	.02403	.03138	.03957
48	.00000	.00140	.00408	.00796	.01296	.01900	.02604	.03403	.04295
49	.00000	.00151	.00443	.00864	.01407	.02064	.02831	.03703	.04679
50	.00000	.00165	.00482	.00941	.01533	.02250	.03088	.04045	.05121
51	.00000	.00180	.00526	.01027	.01675	.02461	.03384	.04441	.05635
52	.00000	.00197	.00576	.01127	.01839	.02707	.03729	.04906	.06255
53	.00000	.00217	.00635	.01239	.02028	.02994	.04136	.05467	.06607
54	.00000	.00240	.00703	.01380	.02261	.03344	.04635	.05744	.06699
55	.00000	.00267	.00786	.01545	.02537	.03767	.04823	.05733	.06515
56	.00000	.00301	.00886	.01744	.02876	.03849	.04686	.05406	.06026
57	.00000	.00341	.01007	.01989	.02835	.03563	.04189	.04727	.05190
58	.00000	.00390	.01154	.01813	.02379	.02866	.03285	.03646	.03956
59	.00000	.00450	.00838	.01171	.01458	.01704	.01916	.02099	.02256

$$a^{ai}_{x:\overline{n-1}|}$$

WHERE *n* EQUALS DURATION IN YEARS

Age	Duration in Years								
	10	11	12	13	14	15	16	17	18
20........	.01307	.01522	.01746	.01978	02218	.02465	.02719	.02979	.03244
21........	.01344	.01569	.01803	.02046	.02297	.02556	.02822	.03094	.03372
22........	.01385	.01620	.01865	.02119	.02382	.02652	.02930	.03214	.03505
23........	.01425	.01670	.01926	.02191	.02465	.02747	.03037	.03334	.03639
24........	.01467	.01722	.01988	.02264	.02550	.02845	.03148	.03460	.03781
25........	.01512	.01777	.02054	.02342	.02640	.02948	.03265	.03592	.03929
26........	.01559	.01834	.02122	.02421	.02732	.03054	.03387	.03731	.04086
27........	.01605	.01890	.02189	.02501	.02826	.03164	.03514	.03876	.04250
28........	.01654	.01950	.02262	.02588	.02929	.03283	.03651	.04032	.04426
29........	.01705	.02013	.02338	.02680	.03038	.03411	.03798	.04200	.04616
30........	.01760	.02082	.02423	.02782	.03158	.03551	.03960	.04384	.04824
31........	.01822	.02160	.02518	.02896	.03293	.03708	.04140	.04589	.05055
32........	.01895	.02251	.02629	.03028	.03447	.03885	.04342	.04818	.05313
33........	.01978	.02353	.02752	.03173	.03616	.04080	.04565	.05070	.05599
34........	.02074	.02470	.02892	.03338	.03808	.04301	.04816	.05354	.05915
35........	.02183	.02603	.03050	.03523	.04022	.04547	.05096	.05670	.06269
36........	.02306	.02751	.03226	.03729	.04261	.04820	.05406	.06020	.06662
37........	.02442	.02916	.03421	.03957	.04524	.05121	.05749	.06407	.07095
38........	.02592	.03096	.03635	.04208	.04814	.05454	.06126	.06832	.07571
39........	.02757	.03295	.03871	.04484	.05133	.05819	.06541	.07300	.08097
40........	.02937	.03512	.04129	.04786	.05484	.06221	.06998	.07816	.08679
41........	.03135	.03751	.04413	.05115	.05865	.06658	.07497	.08383	.09322
42........	.03352	.04014	.04726	.05486	.06294	.07152	.08061	.09026	.10053
43........	.03592	.04306	.05072	.05892	.06766	.07696	.08687	.09744	.10888
44........	.03859	.04628	.05456	.06343	.07293	.08307	.09394	.10570	.11576
45........	.04156	.04987	.05885	.06850	.07886	.09000	.10207	.11242	.12133
46........	.04487	.05390	.06367	.07423	.08562	.09803	.10865	.11780	.12567
47........	.04859	.05843	.06914	.08076	.09347	.10435	.11372	.12178	.12871
48........	.05280	.06360	.07541	.08838	.09949	.10906	.11729	.12437	.13046
49........	.05762	.06955	.08279	.09410	.10384	.11222	.11943	.12562	.13095
50........	.06320	.07664	.08810	.09797	.10646	.11376	.12003	.12543	.13006
51........	.06987	.08142	.09136	.09990	.10725	.11357	.11900	.12367	.12768
52........	.07408	.08401	.09255	.09989	.10620	.11163	.11630	.12030	.12374
53........	.07588	.08431	.09157	.09781	.10317	.10778	.11173	.11513	.11806
54........	.07520	.08227	.08834	.09356	.09805	.10190	.10521	.10805	.11049
55........	.07188	.07767	.08264	.08691	.09058	.09373	.09644	.09877	.10076
56........	.06558	.07016	.07410	.07748	.08038	.08287	.08501	.08685	.08842
57........	.05588	.05931	.06224	.06476	.06693	.06879	.07039	.07175	.07293
58........	.04223	.04451	.04647	.04816	.04961	.05085	.05192	.05283	......
59........	.02391	.02506	.02606	.02691	.02764	.02826	.02880	......	......

$$a^{ai}_{x:\overline{n-1}|}$$

WHERE n EQUALS DURATION IN YEARS

Age	Duration in Years								
	19	20	21	22	23	24	25	26	27
20	.03515	.03791	.04073	.04361	.04655	.04955	.05262	.05576	.05896
21	.03656	.03946	.04243	.04546	.04856	.05173	.05497	.05829	.06168
22	.03803	.04108	.04420	.04740	.05067	.05402	.05745	.06096	.06455
23	.03952	.04273	.04602	.04939	.05284	.05638	.06000	.06371	.06752
24	.04110	.04448	.04795	.05151	.05516	.05890	.06274	.06668	.07072
25	.04276	.04632	.04998	.05374	.05760	.06156	.06563	.06981	.07411
26	.04451	.04827	.05213	.05610	.06018	.06440	.06872	.07316	.07774
27	.04635	.05032	.05440	.05860	.06293	.06739	.07198	.07672	.08161
28	.04833	.05252	.05684	.06130	.06589	.07063	.07552	.08057	.08579
29	.05046	.05490	.05948	.06421	.06910	.07415	.07937	.08477	.09035
30	.05279	.05750	.06237	.06741	.07262	.07801	.08359	.08937	.09536
31	.05538	.06038	.06556	.07093	.07649	.08225	.08822	.09442	.10088
32	.05826	.06359	.06912	.07486	.08081	.08698	.09340	.10009	.10709
33	.06146	.06715	.07306	.07920	.08558	.09221	.09913	.10637	.11399
34	.06500	.07108	.07741	.08399	.09084	.09800	.10549	.11338	.12185
35	.06895	.07546	.08225	.08933	.09672	.10448	.11265	.12143	.12890
36	.07332	.08031	.08761	.09526	.10328	.11174	.12086	.12860	.13526
37	.07815	.08567	.09356	.10186	.11061	.12005	.12806	.13496	.14089
38	.08347	.09160	.10017	.10922	.11903	.12732	.13446	.14061	.14589
39	.08935	.09820	.10755	.11765	.12623	.13362	.13998	.14544	.15014
40	.09590	.10556	.11601	.12488	.13252	.13909	.14475	.14961	.15378
41	.10319	.11399	.12317	.13106	.13785	.14369	.14872	.15303	.15674
42	.11165	.12112	.12928	.13629	.14232	.14750	.15196	.15579	.15908
43	.11865	.12706	.13429	.14051	.14586	.15045	.15440	.15779	.16071
44	.12442	.13187	.13828	.14379	.14852	.15259	.15609	.15909	.16167
45	.12899	.13558	.14125	.14612	.15031	.15390	.15698	.15964	.16192
46	.13243	.13825	.14325	.14755	.15124	.15441	.15713	.15947	.16148
47	.13467	.13979	.14419	.14797	.15122	.15401	.15641	.15846	.16023
48	.13569	.14019	.14405	.14736	.15021	.15266	.15476	.15656	.15811
49	.13552	.13945	.14282	.14573	.14822	.15035	.15219	.15376	......
50	.13404	.13746	.14040	.14293	.14509	.14695	.14854	......	......
51	.13112	.13408	.13662	.13880	.14067	.14228	......	......	......
52	.12669	.12923	.13141	.13328	.13488	......	......	......	......
53	.12056	.12272	.12456	.12614	......	......	......	......	......
54	.11259	.11439	.11593	......	......	......	......	......	......
55	.10248	.10394	......	......	......	......	......	......	......
56	.08977	......	......	......	......	......	......	......	......

$$a^{ai}_{x:\overline{n-1}|}$$

WHERE *n* EQUALS DURATION IN YEARS

Age	Duration in Years								
	28	29	30	31	32	33	34	35	36
20........	.06223	.06558	.06901	.07253	.07614	.07985	.08367	.08760	.09165
21........	.06515	.06871	.07236	.07610	.07995	.08391	.08799	.09219	.09654
22........	.06823	.07201	.07589	.07988	.08398	.08821	.09257	.09708	.10176
23........	.07143	.07545	.07958	.08383	.08821	.09273	.09741	.10226	.10732
24........	.07488	.07916	.08357	.08821	.09280	.09765	.10268	.10793	.11343
25........	.07854	.08310	.08781	.09267	.09770	.10292	.10836	.11407	.12013
26........	.08246	.08733	.09236	.09757	.10298	.10863	.11455	.12085	.12623
27........	.08666	.09187	.09727	.10288	.10873	.11487	.12137	.12696	.13177
28........	.09119	.09678	.10259	.10866	.11503	.12178	.12758	.13257	.13686
29........	.09614	.10216	.10845	.11505	.12212	.12813	.13331	.13776	.14160
30........	.10160	.10812	.11496	.12234	.12858	.13395	.13857	.14254	.14596
31........	.10763	.11472	.12236	.12883	.13440	.13919	.14331	.14685	.14990
32........	.11444	.12233	.12903	.13481	.13977	.14404	.14772	.15087	.15359
33........	.12214	.12909	.13508	.14023	.14465	.14846	.15173	.15455	.15696
34........	.12905	.13526	.14060	.14519	.14913	.15252	.15544	.15794	.16009
35........	.13533	.14086	.14562	.14971	.15322	.15624	.15883	.16106	.16298
36........	.14099	.14592	.15016	.15380	.15693	.15961	.16192	.16390	.16561
37........	.14599	.15038	.15415	.15739	.16018	.16256	.16462	.16638	.16790
38........	.15043	.15433	.15769	.16057	.16304	.16517	.16700	.16856	.16991
39........	.15418	.15765	.16063	.16319	.16539	.16728	.16891	.17030	.17149
40........	.15737	.16045	.16310	.16538	.16733	.16901	.17045	.17168	......
41........	.15993	.16266	.16501	.16703	.16877	.17025	.17153	......	......
42........	.16190	.16433	.16642	.16820	.16974	.17106	......	......	......
43........	.16321	.16536	.16721	.16879	.17015	......	......	......	......
44........	.16388	.16578	.16741	.16881	......	......	......	......	......
45........	.16387	.16555	.16699	......	......	......	......	......	......
46........	.16320	.16467	......	......	......	......	......	......	......
47........	.16174	......	......	......	......	......	......	......	......

$$a^{ai}_{x:\overline{n|}}$$

WHERE *n* EQUALS DURATION IN YEARS

Age	Duration in Years								
	37	38	39	40	41	42	43	44	45
20	.09584	.10037	.10500	.10963	.11449	.11881	.12252	.12572	.12846
21	.10105	.10575	.11067	.11587	.12035	.12421	.12752	.13037	.13283
22	.10664	.11175	.11717	.12182	.12582	.12926	.13222	.13476	.13695
23	.11262	.11828	.12310	.12725	.13082	.13390	.13654	.13881	.14076
24	.11928	.12429	.12860	.13230	.13549	.13823	.14059	.14261	.14435
25	.12533	.12980	.13364	.13695	.13979	.14224	.14434	.14614	.14769
26	.13087	.13486	.13829	.14124	.14378	.14596	.14783	.14944	.15082
27	.13591	.13947	.14253	.14516	.14742	.14936	.15103	.15246	.15369
28	.14056	.14373	.14646	.14880	.15082	.15255	.15403	.15531	.15641
29	.14489	.14772	.15015	.15224	.15403	.15558	.15690	.15804	.15901
30	.14890	.15142	.15358	.15544	.15704	.15842	.15960	.16061	.16147
31	.15251	.15476	.15669	.15835	.15977	.16099	.16204	.16294	......
32	.15591	.15791	.15963	.16111	.16238	.16347	.16440	......	......
33	.15903	.16082	.16235	.16366	.16479	.16575	......	......	......
34	.16194	.16352	.16489	.16605	.16705	......	......	......	......
35	.16462	.16603	.16724	.16828	......	......	......	......	......
36	.16707	.16832	.16940	......	......	......	......	......	......
37	.16920	.17031	......	......	......	......	......	......	......
38	.17106	......	......	......	......	......	......	......	......

Age	Duration in Years								
	46	47	48	49	50	51	52	53	
20	.13083	.13286	.13460	.13610	.13739	.13849	.13944	.14026	......
21	.13493	.13674	.13830	.13963	.14078	.14177	.14261	.14334	......
22	.13883	.14044	.14183	.14302	.14404	.14492	.14568	.14632	......
23	.14243	.14387	.14511	.14617	.14708	.14786	.14853	......	......
24	.14584	.14712	.14823	.14917	.14998	.15068	......	......	......
25	.14902	.15016	.15115	.15199	.15271	......	......	......	......
26	.15200	.15302	.15390	.15464	......	......	......	......	......
27	.15475	.15565	.15643	......	......	......	......	......	......
28	.15735	.15815	......	......	......	......	......	......	......
29	.15985	......	......	......	......	......	......	......	......

Age	Duration in Years								
	54	55							
20	.14096	.14156	......	......	......	......	......	......	......
21	.14396	......	......	......	......	......	......	......	......

RECIPROCALS OF D_x^{aa} USED IN MAKING THE CALCULATIONS DESCRIBED IN THIS ARTICLE

Age	$10^5/D_x^{aa}$	Age	$10^5/D_x^{aa}$
20	$1.95291\bar{2}$	40	$4.20230\bar{4}$
21	$2.02770\bar{2}$	41	$4.37281\bar{8}$
22	$2.10542\dot{3}$	42	$4.55133\bar{2}$
23	$2.18624\bar{3}$	43	$4.73847\dot{4}$
24	$2.27026\bar{4}$	44	$4.93474\bar{8}$
25	$2.35764\dot{5}$	45	$5.14097\bar{1}$
26	$2.44852\dot{9}$	46	$5.35776\bar{8}$
27	$2.54312\pm$	47	$5.58619\bar{6}$
28	$2.64155\dot{2}$	48	$5.82729\underline{\dot{5}}$
29	$2.74398\dot{9}$	49	$6.08222\bar{6}$
30	$2.85067\bar{3}$	50	$6.35256\dot{6}$
31	$2.96182\dot{9}$	51	$6.64003\bar{6}$
32	$3.07759\bar{2}$	52	$6.94649\bar{5}$
33	$3.19824\bar{4}$	53	$7.27407\bar{1}$
34	$3.32401\bar{2}$	54	$7.62521\bar{8}$
35	$3.45513\dot{6}$	55	$8.00288\dot{1}$
36	$3.59186\bar{8}$	56	$8.41077\bar{6}$
37	$3.73461\bar{4}$	57	$8.85328\bar{7}$
38	$3.88362\dot{6}$	68	$9.33549\dot{0}$
39	$4.03942\bar{0}$	59	$9.86343\bar{1}$

$$a_x^{ai} = \frac{{}^{ra}M_x^{ai}}{D_x^{aa}}$$

Age	Amount	Age	Amount
15.........	.1309619	40.........	.1775824
16.........	.1337793	41.........	.1776569
17.........	.1365154	42.........	.1773754
18.........	.1392678	43.........	.1767023
19.........	.1419419	44.........	.1755879
20.........	.1444922	45.........	.1739914
21.........	.1470065	46.........	.1718468
22.........	.1494379	47.........	.1690818
23.........	.1517836	48.........	.1656223
24.........	.1540404	49.........	.1613681
25.........	.1562017	50.........	.1562088
26.........	.1582629	51.........	.1500151
27.........	.1602275	52.........	.1426377
28.........	.1620944	53.........	.1338855
29.........	.1638697	54.........	.1235118
30.........	.1655778	55.........	.1111767
31.........	.1672354	56.........	.0964540
32.........	.1688408	57.........	.0787891
33.........	.1703900	58.........	.0574703
34.........	.1718678	59.........	.0315907
35.........	.1732555		
36.........	.1745207		
37.........	.1756291		
38.........	.1765321		
39.........	.1771970		

DISCUSSION

MR. W. N. BAGLEY: When Mr. Graham asked me to say something about Mr. Bowerman's paper, it occurred to me that there were somewhere in the works similar tables which we prepared about ten years ago by accurately calculating to four decimal places the values for every five ages and obtaining the intermediate values by interpolation. We were happy in learning upon comparison with Mr. Bowerman's tables that we had not been using figures very far out of the way.

Some years ago we used these values frequently but in recent years, due to our method of valuation, we have not used them so much. However, once in a while we have occasion for them, and I agree with Mr. Bowerman's opinion that they are mighty handy things to have around.

Mr. Graham suggested that I might tell you how we compute our disability reserves.

Our regular life reserves are computed by listing the business in force, first by calendar year of issue; second, by policy form; and then by age.

For the old, what we call "advance" clause, that clause issued many years ago which gave a yearly disability benefit of $50 advance per thousand, we compute a premium waiver reserve only, using the same listing as for the regular life reserve.

Later the clause was modified so that, instead of $50 per thousand, the 3½ per cent commuted value of twenty yearly instalments was used, giving $68 per year per thousand. The reserves for this clause are taken as 2¼ times the premium waiver reserves. This is very accurate. [Laughter] If 2 or 2½ were taken as the factor, it might appear as guesswork, but 2¼ should be about right. And if I am not wrong, 2¼ is the exact arithmetic mean of 2 and 2½.

For the clauses chiefly in use at the present time, the premium waiver alone or the premium waiver and monthly income, the reserves may be taken as the gross premiums received. Some companies follow this practice. But this method takes more from the surplus than is really necessary. However, it would be obviously very convenient if satisfactory reserves could be obtained as a direct function of the gross premiums and much easier than to calculate them as the regular reserve is calculated.

Therefore we investigated the various policy forms for four ages, 25, 35, 45, and 55 by taking the ratio of the consecutive years' mean reserves (that is, the first, second, third, and so on) to the extra gross premium. Considering the change in those ratios for the various forms and ages, and at the same time the distribution of the total business by form and age, one can pick a ratio for each policy year which is high enough to surely cover the total mean reserve for the disability provision. This ratio is used regardless of form or age.

It appeared that the difference in these ratios from year to year was very nearly a constant. I do not know what it would be with other companies, but I believe we found a difference of about 45 per cent. For example, on business issued in a certain year, the extra reserve for the first year is taken as, say, 80 per cent of the total gross extra premiums and for the second year as 125 per cent of the same total premiums as before; and so on.

We feel confident that too large a reserve is thus obtained. However, it does not mean putting up the full extra premium and also the method is fully as easy to follow. Certainly much less detail work is required than by figuring with the actual distribution of the policies containing disability benefits.

I do not want to give the impression that these same percentages should be used in all cases. It may be that upon reinvestigation they will have to be changed, and perhaps the change from year to year will be variable instead of a constant.

Neither do I mean to give the impression that every company should use the same figures or even the same method. But Mr. Graham wanted me to say how we do it. So there you are. (Laughter and Applause)

President Graham: I knew if we could get Mr. Bagley to tell us about those reserves we would hear something interesting and entertaining, if not scientific. (Laughter)

Mr. Glover: I would like to say a word about the calculation of disability tables. I have had occasion during the last year to construct fundamental tables from two to eight decimal places and I have found a disagreement to which I would like to call your attention—probably of no practical value but of some theoretical interest.

The l_x^{aa} and l_x^{ii} values are integral in Hunter's tables, and if you glance at the formulas you will observe that there is a functional relation connecting the rate of disability r_x, the probability of living p_x^i among the disabled and between l_x^{aa}, l_x, and l_{x+1}^{aa}. When all these variables but one are known you can calculate that one in terms of the rest. As a matter of fact, the l_x^{aa} is calculated with Hunter's r_x and Hunter's p_x^i. When so calculated, of course, it certainly will not be integral, but it is made integral arbitrarily. The effect of making l_x^{aa} integral is to make l_x^{ii} integral since their sum is equal to l_x. If you now reverse the process and calculate r_x from these integral values a different looking r_x table from the one you started with is obtained.

I have done this and find that r_x instead of going continuously down as in the original table, runs up and down quite irregularly. If we assume that r_x is zero at age 60 and beyond, or 65 and beyond, the same thing occurs then with p_x^i because r_x having vanished, the functional relation is then between p_x^i and l_x^{aa}.

The effect is to cause disagreement beyond the fourth decimal place when you calculate values by the pension formula method and also by the commutation column symbols. This is of practical importance if you wish to calculate by one method and check by another. It is quite impossible now for the reason that you don't know whether the difference after three or four decimal places is due to an error of your operator or due to a discrepancy in the table. It seems to me, therefore, it might be worth while to base l_x^{aa} upon a larger radix or carry it to three or four decimal places. The agreement between pension and commutation formulas is then exact.

Mr. J. P. Bowerman: It has often seemed to me that it is a great waste of energy for different actuaries to be calculating the same kind of tables at the same time. In England when a man intends to prepare some paper that he is willing to offer to the Institute of Actuaries for publication in the *J.I.A.* he notifies the secretary of the Institute of his intention and the secretary then gives him the names of any others who are engaged in preparing similar papers. These men then have an opportunity of preparing a joint paper or of dividing up the work so that one man becomes responsible for one part and the other man for the rest of it. In that way greater results are accomplished with the same effort and greater benefits realized by the members of the Institute.

I would like to suggest to our members that when we are about to make calculations for the benefit of our own company that we are willing to have published in the *Record* that we make known our intentions to the secretary of our Institute so that he can inform us whether other members are then engaged in making similar calculations, and if so, they can either bring out a joint production or divide the work between them.

I thank you for the discussion. I think probably what Dr. Glover said would account for the slight discrepancy between the results obtained by the two different methods referred to by me.

BENEFITS AND CONTRIBUTIONS UNDER RETIREMENT SYSTEMS

By CHARLES E. BROOKS

The records of the American Institute of Actuaries contain a number of important contributions dealing with various aspects of the subject of retirement upon pension. Notable among these are the several scholarly and suggestive papers read by Professor Rietz. In calling the attention of the Institute to an aspect of the problem of retirement pensions which has not received the attention it deserves, the writer is encouraged by the belief that no matter how faulty his own contribution may be, he does not doubt that if he can but provoke a discussion by the members of the Institute, much light will be shed upon some points which have frequently been a source of difficulty.

The actuary who is called upon to assist in the formulation of plans for a pension or retirement system will, ordinarily, be looked to for advice upon many points which are not actuarial—if we give to "actuarial" the narrow interpretation that an actuarial problem is one which can be solved in terms of probabilities of mortality, and rates of interest.

Not the least important of the conditions and regulations of a retirement system are those which prescribe the requirements for retirement. Shall the employee be entitled to enter upon his annuity upon reaching a specified age, or upon completing a definite term of service, or upon satisfying some combination of requirements? If the term of service is to be the basis of retirement, how long shall that term be? If retirement is to be upon attaining a specified age, what age shall be fixed? Upon finding the right answer to these questions must depend to a very great extent, the ultimate satisfactory working of the retirement plan.

When seeking light upon this question, if we turn to what has been done elsewhere, we can find precedent for nearly any combination of requirements, but the variety is so great as to suggest that in general the answers which have been given to this problem have been arbitrary and haphazard rather than founded upon definite principles which can serve as a guide to others. In the narrow field of teachers' pensions alone, age requirements for retirement vary all the way from age fifty to age seventy and service requirements from twenty-five to forty years of service. Frequently age and service requirements are combined. Sometimes there is an alternative of an age or a service requirement and sometimes the annuity is granted only upon completing both an age and a service requirement. Instances are not lacking in which the requirements have been frequently changed. As an example: A very important pension fund supported by a great endowment began by granting retirement allowances after twenty-five years of service. After a few years of operation, the rules were changed to provide for retirement upon reaching the age of sixty-five and the completion of a stated period of service. Not long thereafter, the rules were again modified and seventy years fixed as the age at which the full allowance was to be granted.

Unfortunately, when we examine more closely the cases in which changes of this sort have been made, it not infrequently appears that they occur in funds which are inadequately financed, so that it becomes a natural inference that such changes are often made as attempts to bolster up the finances of unsound funds, rather than that they are improvements based upon a careful study of experience.

Retirement schemes differ as to whether the cost of the pension is to be borne entirely from funds provided by the employer or whether the employee himself contributes. In discussing the effect of various restrictions upon retirement, it will be most helpful if we confine our considerations to benefits granted by the employer.

It is clear that the character of an occupation must be carefully considered in fixing an age for retirement. Where an occupation is such that it calls for vigorous and resourceful men capable of quick initiative and endurance of hardships, comparatively early retirement must be provided. It is notable that funds for policemen and firemen, military pension funds and funds for tropical services frequently provide for early retirement upon generous allowances. Sometimes when such funds permitting early retirement are supported by public money, they are criticized. Such service as that required of our engine and ladder men fighting fires calls for qualities which are ordinarily found only in comparatively young men. It is one of the functions of a retirement scheme to enable those who are no longer able to endure the hardships of the service to be removed in order that their places may be filled by men having the requisite qualities. It is unfair to criticize a retirement fund merely upon the ground that men have been granted annuities before reaching old age. The true ground for criticism in such cases is that the retirement benefits are not so adjusted as to provide a strong inducement for employees who were retired in the prime of life to continue in the service in positions calling for less vigorous qualities.

We are coming to realize that modern industry makes demands upon the human machine which may force us to revise our notions of the normal duration of working life. One recent writer goes so far as to assert that the efficiency of the automatic machine worker reaches its highest point at an age when most of us were in school and that the individual earning capacity begins to diminish very soon thereafter. If this be generally true, it would appear that an industrial pension plan which provides for retirement at the age of sixty-five or seventy, can hardly be expected to work satisfactorily under modern conditions.

A tendency which is observable in recently established pensions systems is toward the granting of increased benefits for service rendered after completing the minimum requirement for retirement. In some of the more carefully planned systems, an increased benefit correctly related to the diminishing cost of an annuity and the increasing accumulation of the fund is granted. Unfortunately, in other cases, this actuarial adjustment has not been made. In such cases, results have sometimes been quite different from those anticipated by the framers of the plan. One pension plan recently investigated by the writer provided for retirement after twenty-five years of service upon an annuity of $312.50. The amount of this annuity was not based upon the amount of contributions, the compensation, or the age or sex of the annuitant. For service longer than the minimum of twenty-five years, an increase of annuity of $12.50 a year was granted. This yearly increase did not continue after the thirty-sixth year of service, at which time the maximum annuity of $450 was available. Note that in this case the increased annuity for a year of service, $12.50, is much less than the correct increase of annuity due to the improvement of the fund by interest and the advanced age of the person. In fact, an employee who continued to serve to the end of the thirty-sixth year did so at an actual sacrifice of nearly $2,000, because the value of the annuity available at the twenty-fifth year, if improved by interest and by the survivorship for eleven years would have provided very much more than the $450 annuity actually available at that time. An analysis of nearly ten years of operation under this plan disclosed some interesting facts. In the first place, the average age of retirement during the period was fifty-one years and the average service before retirement, twenty-nine years. In the second place, there was a very notable rush toward retirement as soon as twenty-five years service had been completed, at which time many persons retired who could undoubtedly have rendered useful service for many years to come. It was also evident that, as a rule, the more highly paid employees were loathe to retire until they had attained to the maximum annuity and further, very few remained in the service after becoming eligible to the maximum annuity. It was indeed true that under this system many employees who had outlived their usefulness were enabled to retire who, in the absence of any system would have continued in the service rendering inefficient service and blocking the promotion of more efficient workers. On the other hand, it is equally true that many worn-out members of the service clung to their positions, because the annuities were so small they could not afford to give up their salaries. In this case, the retirement system failed to yield the expected benefit to the employer, in large measure because the conditions of retirement were not adjusted to the needs of the service.

From what has just been said it will be evident that in fixing an age for retirement, it is essential to take into account not only the conditions affecting the particular service in question but also the purposes which it is expected to accomplish by instituting the retirement system. We cannot hope to arrive at anything approaching a scientific solution of this problem unless we are able to formulate a clear conception of the purpose of a retirement system.

Like all human institutions, the custom of making a provision for aged employees in the form of a life income has been developed through a process of evolution. The modern retirement system covering a great group of employees, giving benefits which are often contractual in character, devised to meet the conditions existing in a modern industry, based upon sound actuarial principles, and secured by reserve funds, has nothing in common with the arbitrary royal grant to a favorite courtier to which the name pension originally belongs, except the fact that the benefit is paid in the form of a life-income. The word "pension" which has been handed down for generations has carried with it meanings and implications derived from its original use and this outworn tradition has served to confuse the minds of those who are planning retirement projects and has been a real and serious obstacle in the development of the modern retirement system.

In its early form, a pension was an arbitrary and presumably unexpected gratuity. It was bestowed according to the personal whim of the giver, and might be given or withheld according to his whim. Thus we have the idea recurring in a thousand forms that a pension or retiring allowance is a charity or gratuity, that it is something for nothing, that it is something entirely over and above wages earned by service.

It would be easy to demonstrate with all the rigor of a mathematical theorem that if wages are governed by the law of supply and demand, a retiring allowance granted after a period of service under a retirement system cannot be a gift. Such an argument is not necessary for our purpose. We know that modern business is conducted in the hope of profit. If a corporation governed by reasonable business men, with sound judgment, establishes a retirement system, it does so with the expectation of increasing profits and not with the idea of making a free gift to its employees. It is quite true that the retirement system may be conceived in the hope of benefiting the employees. But there are other ways of conferring benefits besides giving money. Helping people to help themselves is a substantial form of aid.

It seems clear therefore that, if we undertake the formulation of a retirement system, we must approach the problem from the point of view that the system is to increase profits and not to diminish them. Unless we can do this, we shall be guilty of giving our clients bad advice.

If it be agreed that the cost of the retirement benefit must not be borne by an ultimate reduction of surplus or a dissemination of the capital of the business, then it must follow that the benefits must be paid for either by an increased productivity of the personnel or by a reduction in wages. In either case, then, the cost of the benefit must be earned by the workers. Unless grave injustice is to be done, as between different individuals, the benefits must be earned by those who receive them. If the plan is to prove permanently satisfactory and acceptable it must not injure the position of the worker but must rather improve it. As a practical proposition, therefore, we come down to this: that the retirement plan must so operate as to increase the efficiency of the employees to such an extent that the increased productivity of the force as a whole shall provide for the payment of all benefits and, in addition, contribute to the profits of the enterprise. It must not, of course, be overlooked that the employees may be willing to make contributions in order to increase the benefits which the employer can afford to grant.

The ways in which a suitably designed retirement system can contribute to the efficiency of the service are the following:

1. *Elimination of the superannuated.*—The presence on the pay roll of employees who have outlived their usefulness is a well recognized source of loss. To the excessive cost in wages of the service rendered by the superannuated must be added the increased overhead in providing space, equipment, and management for a worker whose productivity is small. Moreover, the discouragement of younger and more efficient persons who find their promotion clogged frequently has a disorganizing effect upon the whole service. The elimination of the superannuated is always a difficult matter. Long years of faithful service constitute a claim to consideration which cannot easily be overlooked. If the employee has occupied a humble position, it is likely to be the case that he has made no adequate provision for his own old age and that to discharge him is to inflict a real hardship. On the other hand, if he has occupied a position of great responsibility and large emolument, the cost of his retention in the service may be disastrous, but the difficulty of his removal is increased. This situation can be met only by some system of retirement. If the relief sought is to be obtained, it is essential that the retirement benefits and the conditions of retirement be such as to effect a natural and easy withdrawal or removal when the individual ceases to be a profit-

able member of the organization. To accomplish this by an arbitrary age or service rule is, indeed, a delicate task. Yet unless it is accomplished, the retirement system will fail in one of its most important functions.

2. *To attract to the service persons of the desired character and ability.*—Ordinarily, recruits to a service are sought either among the young, in the hope that as they develop the desired skill and experience they will become permanently identified with the organization, or among older people, for the sake of special experience and ability. To neither of these classes does a benefit obtainably only after long service make a very strong appeal. In general, the young do not think seriously of old age, nor do they contemplate long service in one organization. Consequently, long-deferred benefits seem to them to have small present value.

Then, also, employees are apt to have rather shrewd notions of the economics of wages, and however much a philanthropically minded employer may regard his pension as gratuitous, the employees regard it as deferred pay. Pay deferred for a long period and subject to forfeiture is more apt to promote dissatisfaction and resentment than it is to make the employment attractive. In general, it may be said, that if the conditions governing a retirement benefit are such as to suggest that the majority of the employees share only to the extent of contributing either money or service, to create a fund to be enjoyed only by a fortunate few, the effect will be to repeal, rather than to attract.

3. *To retain in the service experienced persons of character and ability.*—This is probably the most valuable service which a carefully planned retirement system can render and at the same time, it is the point at which carelessly framed plans can most utterly fail. The backbone of every organization is a group of capable, experienced, and skilful members of character and enterprise. Yet this group is constantly being depleted by outside attractions with the result that there is a constant tendency toward the proportion of persons who are lacking in initiative to increase. If the promise of a retirement benefit is to constitute a real motive to continuance in the service, all elements of unfairness and uncertainty must be eliminated. The conditions of retirement must be reasonable and such that the employee may feel sure that their fulfilment is within his power and that he does not run a risk of

losing his benefit by circumstances entirely beyond his control. He must be assured that by his constant service he is building up a solid and substantial economic foundation which he has honestly earned and of which he cannot be deprived. Moreover, it is essential that the expected benefit does not carry with it any loss of self-respect.

It is important to note that of the three functions of a retirement system which we have described, in only one, the first, does the actual payment of the pension constitute a feature of prime importance. For the rest, it is the promise or the expectation of the retirement benefit which is the real stimulus to better service. It follows that the chief function of a retirement system is psychological rather than practical. It produces its effect for the most part by the creation of a state of mind in the personnel of the service. It is essential, therefore, that the retirement plan be such as to produce a feeling of fairness, hopefulness, and loyalty in the employee. This cannot be the case if the requirements are such as to render the benefits unattainable to the majority of the workers or if there are any elements of unfairness or any feeling that a burden is imposed upon the majority in order to provide benefits for a small minority.

It does not seem necessary to go into an elaborate analysis of results which may be expected to occur under different conditions of retirement. Enough has been said to make it evident that the formulation of these conditions in such a manner as to yield the desired results to the employer is a difficult problem, one not likely to be satisfactorily solved by arbitrary decisions and almost sure not to be satisfactorily solved if arbitrary decisions are influenced by selfish considerations.

The examination of many retirement systems in the light of considerations like the foregoing has led the writer to the conclusion that arbitrary retirement conditions are almost inevitably unsatisfactory, and that the most hopeful solution of this problem is to be found by the application of methods and principles which have given satisfaction in the conduct of the life insurance business.

Let us therefore abandon the futile attempt to find something which does not exist, namely, a definite age or period at which superannuation occurs. Let us attempt rather to apply some sound actuarial principles to fundamental economic facts in a spirit of justice and fairness. To avoid complexity, let us have in mind only a retirement benefit to be provided by an employer for the purpose of increasing the efficiency of the organization in the manner outlined above. No new principles need be introduced if it should be thought desirable that the employees themselves make contributions to the retirement fund.

The fundamental economic fact on which the system must be based is that the cost of the retirement benefit must be created by the workers themselves as a part of the product of their labors. It is a necessary consequence of this principle that each unit of labor must create its fractional share of the fund from which benefits are to be paid. If this much be admitted, two other important consequences must be accepted. First, an adequate reserve fund must be maintained, to which a contribution is made for each unit of service performed. Second, since each unit of service contributes to the fund, each worker, no matter how great or little his service, contributes by his service a share of the accumulation of which he cannot, in justice, be deprived. We have, therefore, as fundamental principles for an equitable retirement fund, the following, which hold whether the employees contribute either money or service or both.

1. Retirement benefits must be secured and provided for by a reserve fund built up by the employer from the product of service currently as the service is rendered.

2. The contributions to this fund on account of the services of the individual workers must be segregated and allocated to the benefit of the individuals who performed the service.

3. The contributions allocated to the individual must not be forfeited.

Given these fundamentals there is no difficulty in fixing the benefit to be paid. It must be a benefit which is the actuarial equivalent of the individual's accumulation at the time the benefit becomes available. Anything less than this would be a forfeiture and anything more would lead to the inevitable insolvency of the system.

Let us now attack the problem from a different angle, and ask how the amounts of the contributions are to be determined. Here it might appear that we are brought to a standstill, at least, until sufficient experience has been accumulated to enable us to measure in money the actual net increase in productivity resulting from the establishment of a theoretically perfect retirement system. To get about this obstacle, let us frame the question a little differently and ask: "What should be the amount of the retirement benefit?" To the question in this form, I think an answer may be given.

In every productive occupation there exists a type of worker whom I will call the marginal acceptable worker. By this, I mean the person whose abilities are barely sufficient to justify his continuance in the employment. He continues year after year to perform his duties and receive a regular wage. Promotion does not come. On the other hand neither does discharge. He is just good enough to make a bare living and to be tolerated.

Now I think it is a proposition which would command a reasonably general assent that this marginal worker will, if employed continuously throughout the period in which he is able to work, be able to earn enough to provide for his subsistence. If he does not do so, either the industry is not paying its way or the worker will naturally be eliminated or will seek other employment.

I feel sure that we do no violence to the facts if we assume that the marginal worker receives in wages while at work a sum barely sufficient to maintain him in the lowest standard of living compatible with his continuance in the occupation. When he becomes superannuated, therefore, unless he receives a retirement allowance that practically equals the average wage which he has been receiving, he will become an object of charity and a charge upon society.

Having in view the conditions of employment in the particular industry in which our marginal worker is engaged, it should be possible to determine with reasonable accuracy, the number of years of life during which such a worker can expect to be employed. I do not mean an average working lifetime but rather the number of working years which a person of average vitality could work if not interrupted by illness or unemployment. Let us suppose that in the industry in consideration, a worker of this kind begins his employment at the age of twenty and may hope, with good luck, to be continuously employed for fifty years. In such a case the retirement benefit should clearly be a life annuity beginning at age seventy equal in amount to the annual wage of the marginal worker. The contribution of the employer, or rather of the enterprise, to the retirement fund should be the amount necessary to provide this benefit.

It is not the intention by this process of reasoning to fix an age of retirement. The intention is rather to determine a contribution which the industry can bear. There can be no doubt that this rate of contribution is no more than any industry which has a right to existence can afford to pay toward a retirement fund. If the conditions of an industry do not enable the worker who is continuously employed for fifty years at a bare subsistence wage to produce enough to provide a bare subsistence for the remainder of his life, then clearly, the industry is, itself, in need of revision.

By making use of this conception of a marginal employee, we have arrived at something like a natural basis for arriving at a rate of contribution to be made by an employer, or rather, by an enterprise to the retirement fund. With a rate of contribution decided upon, little more remains but to make this rate effective, in conformity with the fundamental principles stated above. As each individual performs his share of service, a contribution on his account is credited to him in the retirement fund. On the principle of non-forfeiture, the benefit becomes the actuarial equivalent of the accumulated contribution at the time the service is terminated, or in good life insurance language, an equitable paid-up value is granted as a non-forfeiture provision.

By this simple plan of following sound life insurance practice, it is possible to do away with arbitrary age and service requirements, and at the same time, to remove many elements of unfairness and points of friction which often defeat the hoped-for beneficial effects of a retirement system.

The employer, when first considering the question from this point of view, is likely to raise two objections. If, he may ask, I permit men to leave my employment, in which they cannot receive an annuity, and pay them an annuity from our fund while they work for my competitor, will I not be benefiting his business at the expense of my own? This is a perfectly fair question. I do not see how it is to be met, except by granting that the interests of both employer and employee require at least one arbitrary restriction: that the benefit shall not be payable while the ex-employee is employed in a competitive enterprise.

His other objection is likely to be that if he permits retirement upon annuity without age or service conditions there is nothing to hold the men in his service. To this there are two replies.

The first is, that free men are better than slaves, even as workers in industry, and that if he attempts to bind men to his service by threats of forfeiture, he is likely to find himself bound to men whom he does not want, and sure to weaken that spirit of loyal co-operation which he seeks to strengthen.

The second answer is, that we can do by fair and acceptable means what we cannot accomplish by force. In such a plan as I have sketched, it will be found that as length of service and age increase, the annuity available will increase, on account of the accumulation of contributions with interest, and the advancing age of the annuitant. This increase of benefit for longer service, even if the level premium plan is followed, is very marked, and if given proper publicity, will create a strong motive for persistency in the service. By adopting a plan by which the contributions of the employer increase with length of service, it is possible to accentuate the increase of benefit to any extent which the character of the organization makes desirable and thus, without increasing the cost of the system, provide so strong a motive for longer service that too early retirement will be reduced to a minimum.

I thank you for your attention. Perhaps I should apologize for occupying the time of the Institute of Actuaries without making a more definite technical contribution, but I hope I shall be justified if I have reminded you that there are vital human problems, outside of our beaten track, to which our science holds the key.

DISCUSSION

H. L. Rietz: By means of this paper, Dr. Brooks has brought before the Institute a very thoughtful consideration of certain difficult problems related to the establishment of pension funds on a satisfactory basis.

As you will recall from hearing the paper, he recognizes especially two major difficulties:

a) The determination of the age and service requirements for a pension.

b) The determination of the amount of pension.

Instead of prescribing age or service requirements, Mr. Brooks proposes to create funds on certain economic principles, and to let the individual employee have much freedom in choosing when funds allocated to him shall be used to provide the actuarial equivalent in the form of a life annuity.

From what Mr. Brooks has described to us as the economic basis of pensions, he arrives at the conclusions that:

1. A reserve for pension should be built up from the product of service currently as service is rendered.

2. Contributions should be segregated and allocated to the individuals.

3. Contributions allocated to individuals should not be forfeited.

With the first two of these principles I am in hearty agreement. With respect to the third principle I appear to be in only partial agreement. At least, this point is debatable. It seems to me that when an employee withdraws without giving long-continued service, the function of the pension system with respect to retaining employees has not been fulfilled, and it then seems equitable that only part of the fund accumulated on behalf of such employee by the employer's contributions should be available as a benefit in the form of a refund or annuity. My view then perhaps differs from that of Mr. Brooks in that I would retain what is similar to a surrender charge until considerable service has been given.

It is practically obvious that in a plan of giving the actuarial equivalent of accumulated contributions we may shift the difficulty of determining the contributions to that of determining the amount of the benefit available at a given age, or vice versa. This difficulty is shifted in the paper to a consideration of the appropriate amount of the pension. Then a criterion as to amount of pension is sought by fixing attention on what is defined as the "marginal acceptable worker"—the person whose abilities are barely sufficient to justify his continuance in the employment.

Perhaps I may well say parenthetically that I think the expression "marginal worker" is used ordinarily in a somewhat different sense from that implied in the definition. As I understand it, the expression is commonly used to mean the worker in that critical situation where an employer barely pays the wages in preference to putting in additional machinery or capital to replace the worker.

But this distinction is a mere scholastic matter. The important matter is that the fundamental assumption is here made that the marginal worker receives wages barely sufficient to maintain him in the lowest standard compatible with his continuance in the occupation. The conclusion that I understand is derived from this assumption is that when the marginal worker retires, he will become an object of charity unless he receives a pension practically equal to the average wage he has been receiving during active service.

It seems to me there is a factor here that has possibly been overlooked in that an old retired man does not, in general, require as much for his subsistence as the same man in the active period of life. This factor is usually more significant in the case of men with families to support than in the case of men without families, but, broadly speaking, I think it is significant in most cases.

In trying to visualize this marginal worker, I wonder whether he would not in many cases be so far below normal that other members of his family would contribute to his support, and whether the basis for amount of pension is not to be sought in examining what economists call a living wage. I do not understand that the wage of this marginal worker is necessarily a living wage in the sense that a living wage is one on which the man can support a family.

Next, the author regards it as possible to determine with reasonable accuracy, under the conditions of employment in a particular industry, the number of years which a person of average vitality can work. If this is practicable, we seem to have in this process a method of fixing an appropriate age of retirement for the group of marginal employees. But the paper states that it is not the intention of this process to fix an age of retirement. The intention is to determine the contribution which the industry can bear.

I am not clear about this part of the reasoning, but the inference is drawn that the industry needs revision unless it will produce sufficient profits so that it could give the retiring marginal employee an amount equal to wages as an old-age pension. This is a very suggestive statement, and I have been interested in making inquiry of some economists about the revision of industry when its profits are thus limited. I consulted in particular Professor R. W. Stone, of the University of Iowa, who has made a special study of labor problems. He informs me that it is by no means well established that industry as a whole can afford to pay every man a living wage, meaning by this a wage sufficient to properly support a family. If his view is correct, one would hardly feel that an industry needs revision simply because it cannot provide old-age pensions equal to the wages of the marginal worker.

Mr. Brooks has considered the main drawbacks to perfect freedom to withdraw without forfeiture of any part of the accumulations for pension. As an additional point it seems to me not entirely consistent with what is conceived to be one of the functions of a pension system to give a withdrawing employee the total of the accumulated contributions unless he has given long-continued service. While we should be fair to the withdrawing employee, there is some danger that we *may* go too far and overlook the fact that something is earned by long-continued service.

Although I recognize with the author of the paper that from a certain individualistic standpoint, no definite age of retirement exists that is appropriate, I think there is nevertheless some advantage—perhaps one may call it a psychological advantage—in naming an approximate age for old-age retirement. At least, that is my feeling. When we say that no definite age of retirement exists, may we not by analogy say there is no definite age such as 21, at which all men should vote? The requirement of age 21 is the test we use for convenience, and it is part of democracy and good government to submit to such tests, although some men are better prepared to vote at 18 than others will be at 40.

It has been my judgment that a standard age of retirement is a desirable goal, but that some flexibility should be introduced by permitting earlier retirement by at least five years on a smaller pension by exchanging actuarial equivalents in accord with the ideas of Mr. Brooks.

In conclusion, let me say that although I have offered certain criticisms, I feel that we are much indebted to Mr. Brooks for ideas some of which he has put into concrete form in a state teachers' fund. May I express the hope that the theory regarding the marginal worker will be reduced to figures by presenting concrete cases, and that we may then see that such a theory would prove satisfactory in the cases of the normal and most efficient workers, or that certain modifications are necessary for such employees. Then I think we shall be in a better position to see the advantages and disadvantages of the proposed plan in comparison with plans containing the arbitrary elements to which our attention has been so well drawn by the paper.

Mr. Glover: I am interested in that phase of Dr. Brooks's paper which deals with questions out of the narrow actuarial field. He says "The actuary who is called upon to assist in the formulation of plans for a pension or retirement system will ordinarily be looked to for advice upon many points which are not actuarial, if we give to 'actuarial' the narrow interpretation that an actuarial problem is one which can be solved in terms of probabilities of mortality and rates of interest."

It is evident that in recent years the actuary has been working out of this field and to some minds he is getting out of his proper province. The last annual report of the Carnegie Foundation for the Advancement of Teaching bears directly upon this situation. The thesis is briefly that actuaries should stick to their figures and their tables and that they are not justified in attempting to determine the social principles underlying pensions.

I think the trend of events shows, however, that the modern actuary who is skilled in mathematics and competent to undertake important problems relating to pensions must also be broad enough to give advice along the lines indicated in this paper. Clients who look to him for advice generally have given but little thought to the variety of questions which arise. And we all know that wise handling of these questions requires considerable experience, the kind of experience which the actuary alone acquires in the course of constructing various pension schemes.

I think that the tendency as indicated by Dr. Brooks's paper is toward flexibility and elasticity. I am not sure that there is any one plan or any three fundamental propositions upon which we can build all pension systems. It seems to me that everyone requires individual study, and the more experience there is behind that study the more likely is the conclusion of the actuary to be sound.

I think the amount of surrender charge must be measured perhaps by the immediate problem in hand. In life insurance we have gradually worked down from large surrender charges to almost no surrender charge. Perhaps the same thing will occur as we gain more experience in pension systems.

The paper by Dr. Brooks is not at all technical. It is rather of the broader type and I think we owe a debt of gratitude to him for presenting to our Institute a paper of this character.

H. R. CORBETT: The author of this paper modestly makes apology for "the lack of a more definite technical contribution." The pension problem consists chiefly of just such questions as Dr. Brooks has discussed—questions of expediency and psychology and complex industrial conditions. The actuarial processes involved are rather elementary. The contributions of McLauchlan in the *Transactions of the Faculty* and of Manly and King in the *Journal of the Institute* cover the technical field so completely as to leave little room for additions.

In the case of insurance the processes are quite complex, and new problems constantly arising call for technical solutions, while many non-technical questions can be relegated to other insurance literature which is voluminous and highly specialized. It includes the proceedings of various organizations such as the Life Insurance Presidents, the Life Convention, the Insurance Commissioners, the Fraternal Congress, the great underwriters' associations, the publications of life insurance companies, and most comprehensive of all, the Insurance Press, all open to non-technical discussions which in the insurance field are somewhat analogous to the subjects which Professor Brooks has summarized in this article for the pension field. Until other channels are provided, it seems that a reasonable amount of time in our meetings and space in our *Record* might well be assigned to the general economy of pensions, a subject which certainly belongs under the actuaries' care.

Dr. Brooks states as a "fundamental economic fact that the cost of the retirement benefits must be created by the workers themselves as a part of the product of their labors." It follows that the contributions of the worker are of two classes—direct contributions deducted from their wages and indirect contributions resulting from increased efficiency caused by the pension fund itself. Public sentiment may sometime demand that instead of deductions from wages, such portion of the cost be added to the cost of the product and paid for by the ultimate consumer, like workmen's compensation today.

We come now to the important question of non-forfeiture referred to in the article. There seems good reason for holding that the direct contributions deducted from wages should be returned with reasonable interest upon withdrawal of the employee from service.

It is evident that if the entire contributions, both direct and indirect, were withdrawable upon leaving employment, there would be little if any tendency to retain employees in service, which tendency is one of the objects of establishing a pension fund. But since the amount of the indirect contributions is difficult or impossible to determine, it ought probably to be understood that such contributions. i.e., the indefinite results of increased efficiency, should be forfeited at withdrawal, and this will tend to retain the workers in the service.

I believe, with Dr. Rietz, that the annuity paid to a man after age 70 need not be equal to the wage paid him in the years when he was younger, more ambitious and active, and supporting a family.

The difficulty of establishing a pension fund and paying for it are very great under present industrial conditions, and the friends of the movement should content themselves at this time with advocating a minimum measure of the amount of annuity. Moreover, it is a question of public policy whether the incentive to thrift should be withdrawn. Even after the establishment of a pension fund there should no doubt be strong inducement for every worker to save something for his old age in addition to his annuity.

The author enumerates three ways in which a retirement system can contribute to the efficiency of a worker: (1) elimination of the superannuated, (2) attracting desirable persons, and (3) retaining such persons in the service. He omits one of the most important, and possibly his reason for so doing is because it is sufficiently obvious without special enumeration. I refer to the increased productive efficiency of the employees in their daily work. There is much wasteful carelessness and much that might be termed voluntary inefficiency which tends to disappear when the employees are more contented and in greater sympathy with the management. There is, furthermore, a cynicism and unrest due largely to anxiety about the future or to a stolid discouragement in regard to providing for it. To meet this psychological condition is the most important object of the pension fund. It is never possible to measure the degree to which waste can be removed and efficiency of production stimulated; but every wise management knows that it is an end deserving of most careful effort.

Let me direct a moment's attention to some serious difficulties an employer meets under present conditions in the establishing of a pension fund. The cost is such as to require not only contributions such as the employer can afford on account of increased efficiency, but also considerable direct contributions in the form of deductions from wages. To this the labor unions are resolutely opposed. The chief desire of their leaders is to promote the mobility of labor. Their most effective weapon is the strike, and they are fundamentally opposed to any scheme that tends to hold employees in service.

The second difficulty consists in the almost universal ignorance among employees as to the value of an annuity. Absurd as it may seem, a lump payment of $2,000 promised at age 70 would generally sound more attractive to the average employee than a life annuity at that age of say, $500.00. I have sometimes thought that in order to educate employees as to the value of annuities, it might be well to announce a pension plan by stating the benefit as the amount of reserve required at the age of retirement, specifying that this larger sum is to be invested in a life annuity of the designated amount.

I might add that this last fact perhaps constitutes one great advantage of group insurance. In a certain sense it is in competition with pensions where the employer is seeking some means to produce the psychological result that Dr. Brooks describes. The employees know little about the cost of pensions and they are almost certain to estimate the cost at a great deal less than it actually does cost the employer. On the other hand, they know a great deal about insurance. They have purchased it by expensive methods, and they know of others that have done so, and the rate they place upon the value of it is usually greater than it costs the employer under the group insurance system. Therefore, when the employer is comparing the two, if he thoroughly understands the situation he will see that he is getting more appreciation for his money in buying group insurance than he is in buying pensions, in the majority of cases.

Mr. Brooks: I am very much pleased to have provoked such a lively discussion of some points relating to pensions.

I would like to say just a word or two. First, as to Professor Rietz's comments on what I have called the marginal man. I accept his correction in the use of the word there very gratefully. I think possibly he has made my suggestion seem a little more positive than I intended it to be. I meant it to be suggestive rather than assertive.

I would like also to say a word on something that Mr. Corbett said. He intimated that the technical actuarial problems in regard to pension funds were rather simple. In the main I think that is true but there is one problem that arises in connection with a pension fund of any magnitude that is not quite so simple as it seems. In dealing with life insurance through the last century we have been very fortunate in that we have had to deal with a constant improvement in longevity and almost any mortality table that was founded on observations of a hundred years ago or fifty years ago or now is a pretty safe table for life insurance for the next generation. Now, that is not at all true in regard to granting annuities. A pension fund, for instance, a state teachers' pension fund which may be dealing wlth twenty or thirty thousand members, granting large numbers of annuities and the annuities of a value of $10,000 to $20,000 apiece, is confronted with a very serious actuarial problem in controlllng its funds and making its rates in view of the increase in the longevity of annuitants. We don't know how long annuitants live but we know that every time we make an investigation they live longer than they did the last time. I think that is one rather serious actuarial problem involved in pension work.

AN ACTUAL EXPERIENCE OF THE DOUBLE INDEMNITY FEATURE OF THE LIFE INSURANCE POLICY

By R. MONTAGUE WEBB

The double indemnity provision of the life insurance policy has become a regular feature like the various disability provisions or the return premium riders: and while much has been written about it, and much discussion has taken place as to the correct or the sufficient extra to be charged, still I, and others in the Institute, have considered that it would be neither going over old ground nor lacking in interest if I reviewed the actual experience of a company which has been writing this form of indemnity from the year 1909, although it was not until the year 1914 that the volume had attained $20,000,000.

The present contribution is therefore neither expository of a new theory nor explanatory of an old one—it misses both novelty and reiteration—nevertheless I believe it will have an interest because it is not explanatory, and also because it is solely and purposely a setting down of actual facts and results. It is not in any way claimed at the outset that the basis was correct, but I do submit that the results expected from the original assumptions are so close to the actual facts as they afterward appeared, and as they are still appearing, that the basic tables may be used as a reliable guide to future operations in the granting of the Double Indemnity feature.

Some thirteen years ago I extracted from the census returns of the United States bureau the statistics there available which finally exhibited the deaths from accidental causes in comparison with deaths from all causes. In making my extracts from the returns I omitted or rejected as far as possible deaths from accident in occupations that were not acceptable for insurance: deaths among classes of the population that were not insured by the company—practically all non-Caucasians. I also omitted women. Moreover I rejected those parts of the country within the confines of which it was at that time highly improbable that the Company would consider any applications for this class of business. For comparison I could find only some very meager figures published by the Traveller's Insurance Company, at about five or six ages—nevertheless I did not disdain them but incorporated them in my own deductions from the census which were at first at quinquennial age groups. From these groups I finally deduced the probabilities, at every fifth age, that a death having occurred it was due to accident. This basic table is given here:

Age	*q*	Age	*q*	Age	*q*
20	.1473	41	.0963	62	.0352
21	.1449	42	.0933	63	.0333
22	.1425	43	.0902	64	.0315
23	.1400	44	.0872	65	.0299
24	.1377	45	.0842	66	.0282
25	.1354	46	.0808	67	.0264
26	.1333	47	.0774	68	.0244
27	.1313	48	.0739	69	.0223
28	.1294	49	.0704	70	.0200
29	.1276	50	.0669	71	.0177
30	.1258	51	.0640	72	.0156
31	.1235	52	.0611	73	.0136
32	.1212	53	.0582	74	.0118
33	.1188	54	.0552	75	.0100
34	.1164	55	.0522	76	.0082
35	.1140	56	.0498	77	.0064
36	.1113	57	.0473	78	.0044
37	.1084	58	.0448	79	.0023
38	.1054	59	.0423	80	.0000
39	.1023	60	.0398		
40	.0994	61	.0374		

The following tabulations exhibit the result of a detailed examination of the actual double indemnity insurance by amounts at each age exposed during the years 1916 to 1921, together with the factor, per $1,000 of the exposed, and the expected claims. These figures are actual experience and have not been subjected to any manner of adjustment or smoothing of irregularities. The object has been to exhibit simply the figures and experience, permitting the incidence of all influences to appear: in preparing the figures, or rather in gathering them, I was of opinion, and still am of the opinion, that this is not the occasion to subject these crude but actual results to any refinements, however necessary or desirable it may be found to eliminate evident—but slight—irregularities due to causes peculiar to the company or the field conditions,

EXPECTED CLAIMS, FROM DEATH DUE TO ACCIDENT, BY YEARS AND ATTAINED AGE

Attained Age	Special Probability of Death Multiplied by 1000	Expected Claims for the Year			
		1916		1917	
		Exposed	Expected	Exposed	Expected
20	1.157	$374,000	$433	$683,000	$790
21	1.144	705,000	807	903,000	1,033
22	1.133	902,000	1,022	973,000	1,102
23	1.121	892,000	1,000	1,115,000	1,250
24	1.109	911,000	1,010	1,178,000	1,306
25	1.098	946,000	1,039	1,148,000	1,261
26	1.088	1,033,000	1,124	1,158,000	1,260
27	1.080	1,037,000	1,120	1,274,000	1,376
28	1.073	1,070,000	1,148	1,301,000	1,396
29	1.067	1,062,000	1,133	1,291,000	1,377
30	1.063	1,114,000	1,184	1,272,000	1,352
31	1.056	1,062,000	1,121	1,298,000	1,371
32	1.047	1,176,000	1,231	1,247,000	1,306
33	1.040	977,000	1,016	1,355,000	1,409
34	1.032	1,010,000	1,042	1,151,000	1,188
35	1.024	943,000	966	1,182,000	1,210
36	1.016	997,000	1,013	1,119,000	1,137
37	1.007	1,592,000	1,603	1,156,000	1,164
38	.997	921,000	918	1,715,000	1,710
39	.987	897,000	885	1,070,000	1,056
40	.978	910,000	890	1,049,000	1,026
41	.969	825,000	799	1,006,000	975
42	.961	769,000	739	905,000	870
43	.953	682,000	650	846,000	806
44	.947	700,000	663	754,000	714
45	.942	650,000	612	762,000	718
46	.937	598,000	560	694,000	650
47	.932	547,000	510	633,000	590
48	.927	476,000	441	556,000	515
49	.924	422,000	390	481,000	444
50	.923	427,000	394	428,000	395
51	.927	293,000	272	435,000	403
52	.936	257,000	241	303,000	284
53	.946	219,000	207	247,000	234
54	.956	236,000	226	239,000	228
55	.965	256,000	247	223,000	215
56	.980	190,000	186	248,000	243
57	1.000	169,000	169	183,000	183
58	1.019	134,000	137	154,000	157
59	1.037	121,000	125	125,000	130
60	1.054	102,000	108	111,000	117
61	1.071	59,000	63	90,000	96
62	1.091	56,000	61	48,000	52
63	1.116	33,000	37	48,000	54
64	1.146	35,000	40	29,000	33
65	1.181	98,000	116	112,000	132
		$28,885,000	$29,698	$34,298,000	$35,318

EXPECTED CLAIMS, FROM DEATH DUE TO ACCIDENT, BY YEARS AND ATTAINED AGE

Attained Age	Special Probability of Death Multiplied by 1000	Expected Claims for the Year			
		1918		1919	
		Exposed	Expected	Exposed	Expected
20........	1.157	$ 502,000	$ 581	$ 911,000	$ 1,054
21........	1.144	1,274,000	1,457	1,247,000	1,427
22........	1.133	1,067,000	1,209	1,489,000	1,687
23........	1.121	1,188,000	1,332	1,334,000	1,495
24........	1,109	1,373,000	1,523	1,512,000	1,677
25........	1,098	1,486,000	1,632	1,701,000	1,868
26........	1.088	1,439,000	1,566	1,894,000	2,061
27........	1.080	1,402,000	1,514	1,868,000	2,017
28........	1,073	1,550,000	1,663	1,825,000	1,958
29........	1.067	1,633,000	1,742	2,022,000	2,157
30........	1.063	1,561,000	1,659	2,144,000	2,279
31........	1.056	1,557,000	1,644	2,086,000	2,203
32........	1.047	1,567,000	1,641	2,036,000	2,132
33........	1,040	1,544,000	1,606	2,158,000	2,244
34........	1,032	1,683,000	1,737	2,133,000	2,201
35........	1.024	1,429,000	1,463	2,257,000	2,311
36........	1.016	1,468,000	1,491	1,947,000	1,978
37........	1.007	1,395,000	1,405	1,937,000	1,951
38........	.997	1,435,000	1,431	1,852,000	1,846
39........	.987	1,288,000	1,271	1,898,000	1,873
40........	.978	1,329,000	1,300	1,656,000	1,620
41........	.969	1,260,000	1,221	1,733,000	1,679
42........	.961	1,192,000	1,146	1,606,000	1,543
43........	.953	1,081,000	1,030	1,550,000	1,477
44........	.947	977,000	925	1,372,000	1,299
45........	.942	899,000	847	1,222,000	1,151
46........	.937	896,000	840	1,159,000	1,086
47........	.932	805,000	750	1,166,000	1,087
48........	.927	704,000	653	1,002,000	929
49........	.924	626,000	578	876,000	809
50........	.923	516,000	476	803,000	741
51........	.927	445,000	413	628,000	582
52........	.936	453,000	424	527,000	493
53........	.946	322,000	305	543,000	514
54........	.956	255,000	244	357,000	341
55........	.965	269,000	260	274,000	264
56........	.980	224,000	220	290,000	284
57........	1.000	241,000	241	229,000	229
58........	1.019	178,000	181	247,000	252
59........	1.037	145,000	150	201,000	208
60........	1.054	123,000	130	150,000	158
61........	1.071	101,000	108	126,000	135
62........	1.091	80,000	87	100,000	109
63........	1.116	44,000	49	79,000	88
64........	1.146	45,000	52	50,000	57
65........	1.181	126,000	149	155,000	183
		$41,177,000	$42,346	$54,352,000	$55,737

EXPECTED CLAIMS, FROM DEATH DUE TO ACCIDENT, BY YEARS AND ATTAINED AGE

Attained Age	Special Probability of Death Multiplied by 1000	Expected Claims for the Year			
		1920		1921	
		Exposed	Expected	Exposed	Expected
20	1.157	$1,018,000	$1,178	$ 409,000	$ 473
21	1.144	1,923,000	2,200	1,143,000	1,308
22	1.133	1,582,000	1,792	2,036,000	2,307
23	1.121	1,870,000	2,096	1,708,000	1,915
24	1.109	1,777,000	1,971	1,991,000	2,208
25	1,098	1,990,000	2,185	1,906,000	2,093
26	1.088	2,155,000	2,345	2,113,000	2,299
27	1.080	2,376,000	2,566	2,277,000	2,459
28	1.073	2,373,000	2,546	2,495,000	2,677
29	1.067	2,355,000	2,513	2,489,000	2,656
30	1.063	2,533,000	2,693	2,464,000	2,619
31	1.056	2,637,000	2,785	2,635,000	2,783
32	1,047	2,599,000	2,721	2,741,000	2,870
33	1.040	2,450,000	2,548	2,677,000	2,784
34	1.032	2,678,000	2,764	2,545,000	2,626
35	1.024	2,658,000	2,722	2,776,000	2,843
36	1.016	2,705,000	2,748	2,732,000	2,776
37	1.007	2,383,000	2,400	2,778,000	2,797
38	.997	2,346,000	2,339	2,457,000	2,450
39	.987	2,228,000	2,199	2,423,000	2,392
40	.978	2,490,000	2,435	2,298,000	2,247
41	.969	1,904,000	1,845	2,515,000	2,437
42	.961	2,005,000	1,927	1,953,000	1,877
43	.953	1,855,000	1,768	2,032,000	1,937
44	.947	1,777,000	1,683	1,894,000	1,794
45	.942	1,584,000	1,492	1,811,000	1,706
46	.937	1,427,000	1,337	1,618,000	1,516
47	.932	1,318,000	1,228	1,453,000	1,354
48	.927	1,327,000	1,230	1,350,000	1,251
49	.924	1,108,000	1,024	1,337,000	1,235
50	.923	969,000	894	1,113,000	1,027
51	.927	886,000	821	975,000	904
52	.936	672,000	629	887,000	830
53	.946	579,000	548	680,000	643
54	.956	588,000	562	580,000	554
55	.965	363,000	350	581,000	561
56	.980	312,000	306	364,000	357
57	1.000	303,000	303	312,000	312
58	1.019	266,000	271	307,000	313
59	1.037	259,000	269	263,000	273
60	1.054	205,000	216	254,000	268
61	1.071	139,000	149	198,000	212
62	1.091	117,000	128	139,000	152
63	1.116	99,000	110	112,000	125
64	1.146	72,000	83	99,000	113
65	1.181	179,000	211	251,000	296
		$67,439,000	$69,130	$70,171,000	$71,629

in a final smoothing and balancing process considered perhaps necessary before using this experience and investigation for the practical purposes of business.

These tabulations cover the years 1916 to 1921 both inclusive. The figures for the years prior to these were too irregular and included insufficient exposures to be of any value for an age to age exhibit. The period selected covers $28,885,000 of total exposures during 1916, $34,298,000 during 1917, $41,177,000 during 1918, $54,352,000 during 1919, $67,439,000 during 1920, and $70,171,000 during 1921, an extremely irregular sequence of exposures.

The actual claims for each of these years have been compiled with the greatest care and accuracy, and are here shown without any corrections or adjustments:

Year	Exposed	Actual Claim	Expected Claim	Per Cent
1916............	$28,885,000	$14,500	$29,698	48.82
1917............	34,298,000	22,000	35,318	62.29
1918............	41,177,000	29,500	42,346	69.66
1919............	54,352,000	57,600	55,737	103.34
1920............	67,439,000	66,500	69,130	96.20
1921............	70,171,000	74,000	71,629	103.31

In aggregates from one to six years these figures give

Year	Exposed	Actual Claim	Expected Claim	Per Cent
1916–21.........	$296,322,000	$264,100	$303,858	86.92
1917–21.........	267,437,000	249,600	274,160	91.04
1918–21.........	233,139,000	227,600	238,842	95.29
1919–21.........	191,962,000	198,100	196,496	100.82
1920–21.........	137,610,000	140,500	140,759	99.82

The years 1920 and 1921 with exposures of almost equal amounts show actual total claims of $140,500 as compared with a tabular expected of $140,759. The same close agreement is shown also for the three years 1919, 1920, and 1921, during which period the actual claims were 100.82 per cent of the calculations. I believe the exposures during these years have been sufficiently great to warrant the plea, that my original calculations of the probabilities of death from accident are substantiated by the results as soon as the exposures arrive at a magnitude which practically forbids the influence of locality and occupational hazard. Moreover the experience has passed through two great disturbing periods—that of the war and epidemic, and a period of extraordinarily numerous accidental deaths, not I believe peculiar to one company alone.

Passing now to the adoption of the experience as a fair guide to future expectations, I have constructed a short set of auxiliary tables: the first table gives by ages from 20 to 65 the probability that death will occur as the result of accident. This table was formed from the American experience probability of death modified by the factor that death having occurred it was due to accident (column 3). For the purposes of ascertaining the expected claims I have added a column (4) showing the mean probabilities from ages 20 to 65.

From these probabilities the necessary modified C and M columns are formed: the C column is most conveniently calculated from the American $3\frac{1}{2}$ C by the factor in column (2) of the preceding table.

For valuation purposes a calculation of the K column has been made for use in cases where a continuous form of valuation is considered advisable or expedient. This column is formed expeditiously by the division of the special C by the regular D at an age one year higher.

From these commutation columns I show a net adjusted premium for the risk, age by age, over the usual period of twenty years, the premium being continuous over the period. These premiums commencing at $1.04 at age 20 decrease to $0.92 at ages 35 to 42, and increase somewhat more rapidly, to $1.08 at age 60.

I have purposely made no attempt to guide the calculation of gross premiums. I have considered the exhibition of the net figures in all cases as the thing desired in this contribution. The object sought in the compilation of the original statistics was a factor which would give a safe premium which would cover the risk: the question of a surplus was not considered and, at that time, the risk was assumed to be from year to year, and a valuation was not thought at that time either necessary or possible.

It may be asked, and very properly, what have been the conditions of granting this form of insurance over the years covered by these figures, and whether the classes of risks have varied to any extent during the period. The answer to these queries is extremely simple. The attempt has been absolutely uniform during the whole period to exclude from this benefit all but first-class insurance risks from the point of view of physical fitness, absence of occupational hazard, and absence of those other hazards of financial, personal, and environing influences that we class as moral risks. The insurance has been limited to residents of the continental United States, excluding certain sections that have been considered unhealthy, and excluding all races except Caucasian, excluding also Indians and mixed races such as exist in Mexico. The age limit has been practically 20 with a few below, but none below 15, and in the case of women only those who were entitled to any class of life insurance.

There remains to mention the valuation method to be used: I am of opinion that the practical plan is to treat the business as renewable yearly and not attempt an accumulative reserve from year to year. The unadjusted figures of this paper give negative values at age 35 on a net premium of .9311 per thousand: these figures are as follows:

TABLE OF PROBABILITIES

Age	American Experience q	Probability That Death Was Due to Accident	q'	Mean q'
20	.007805	.1473	.001150	.001157
21	.007855	.1449	.001138	.001144
22	.007906	.1425	.001127	.001133
23	.007958	.1400	.001114	.001121
24	.008011	.1377	.001103	.001109
25	.008065	.1354	.001092	.001098
26	.008130	1333	.001084	.001088
27	.008197	.1313	.001076	.001080
28	.008264	.1294	.001069	.001073
29	.008345	.1276	.101065	.001067
30	.008427	.1258	.001060	.001063
31	.008510	.1235	.001051	.001056
32	.008607	.1212	.001043	.001047
33	.008718	.1188	.001036	.001040
34	.008831	.1164	.001028	.001032
35	.008946	.1140	.001020	.001024
36	.009089	.1113	.001012	.001016
37	.009234	.1084	.001001	.001007
38	.009408	.1054	.000992	.000997
39	.009586	.1023	.000981	.000987
40	.009794	.0994	.000974	.000978
41	.010008	.0963	.000964	.000969
42	.010252	.0933	.000957	.000961
43	.010517	.0902	.000949	.000953
44	.010829	.0872	.000944	.000947
45	.011163	.0842	.000940	.000942
46	.011562	.0808	.000934	.000937
47	.012000	.0774	.000929	.000932
48	.012509	.0739	.000924	.000927
49	.013106	.0704	.000923	.000924
50	.013781	.0669	.000922	.000923
51	.014541	.0640	.000931	.000927
52	.015389	.0611	.000940	.000936
53	.016333	.0582	.000951	.000946
54	.017396	.0552	.000960	.000956
55	.018571	.0522	.000969	.000965
56	.019885	.0498	.000990	.000980
57	.021335	.0473	.001009	.001000
58	.022936	.0448	.001028	.001019
59	.024720	.0423	.001046	.001037
60	.026693	.0398	.001062	.001054
61	.028880	.0374	.001080	.001071
62	.031292	.0352	.001101	.001091
63	.033943	.0333	.001130	.001116
64	.036873	.0315	.001161	.001146
65	.040129	.0299	.001200	.001181

COMMUTATION AND VALUATION TABLE

Age	*C′*	*M′*	*K′*	Age	*C′*	*M′*	*K′*
20...	51.72	989.68	1.1588	50...	11.13	177.05	.9345
21...	49.08	937.96	1.1472	51...	10.71	165.92	.9445
22...	46.57	888.88	1.1356	52...	10.30	155.21	.9548
23...	44.14	842.31	1.1230	53...	9.91	144.91	.9666
24...	41.89	798.17	1.1119	54...	9.51	135.00	.9770
25...	39.74	756.28	1.1006	55...	9.12	125.49	.9881
26...	37.80	716.54	1.0924	56...	8.83	116.37	1.0103
27...	35.98	678.74	1.0851	57...	8.52	107.54	1.0309
28...	34.27	642.76	1.0786	58...	8.20	99.02	1.0510
29...	32.69	608.49	1.0739	59...	7.88	90.82	1.0719
30...	31.17	575.80	1.0688	60...	7.55	82.94	1.0921
31...	29.62	544.63	1.0602	61...	7.21	75.39	1.1115
32...	28.16	515.01	1.0523	62...	6.90	68.18	1.1365
33...	26.78	486.85	1.0449	63...	6.63	61.28	1.1700
34...	25.45	460.07	1.0369	64...	6.36	54.65	1.2061
35...	24.19	434.62	1.0292	65...	6.11	48.29	1.2493
36...	22.97	410.43	1.0208	66...	5.82	42.18	1.2880
37...	21.76	387.46	1.0102	67...	5.49	36.36	1.3204
38...	20.64	365.70	1.0012	68...	5.10	30.87	1.3392
39...	19.53	345.06	.9900	69...	4.66	25.77	1.3427
40...	18.56	325.53	.9834	70...	4.16	21.11	1.3226
41...	17.57	306.97	.9733	71...	3.64	16.95	1.2847
42...	16.68	289.40	.9662	72...	3.15	13.31	1.2422
43...	15.82	272.72	.9585	73...	2.67	10.16	1.1848
44...	15.06	256.90	.9548	74...	2.24	7.49	1.1268
45...	14.32	241.84	.9502	75...	1.81	5.25	1.0406
46...	13.60	227.52	.9450	76...	1.41	3.44	.9346
47...	12.92	213.92	.9404	77...	1.04	2.03	.8026
48...	12.27	201.00	.9361	78...	.67	.99	.6087
49...	11.68	188.73	.9345	79...	.32	.32	.3466

NET PREMIUM PAYABLE FOR FULL 20 YEARS TO CARRY THE RISK FOR 20 YEARS. PER $1,000

Age	Premium	Age	Premium	Age	Premium
20.......	1.0374	34.......	.9358	48.......	.9745
21.......	1.0287	35.......	.9311	49.......	.9877
22.......	1.0201	36.......	.9271	50.......	1.0016
23.......	1.0119	37.......	.9241	51.......	1.0157
24.......	1.0039	38.......	.9223	52.......	1.0290
25.......	.9963	39.......	.9216	53.......	1.0414
26.......	.9890	40.......	.9222	54.......	1.0525
27.......	.9818	41.......	.9238	55.......	1.0627
28.......	.9747	42.......	.9267	56.......	1.0714
29.......	.9676	43.......	.9308	57.......	1.0776
30.......	.9605	44.......	.9365	58.......	1.0810
31.......	.9535	45.......	.9436	59.......	1.0811
32.......	.9470	46.......	.9523	60.......	1.0770
33.......	.9411	47.......	.9626		

Year	Reserve	Year	Reserve
1	.0568	11	.2177
2	.1076	12	.1980
3	.1499	13	.1724
4	.1850	14	.1409
5	.2103	15	.1058
6	.2300	16	.0684
7	.2403	17	.0384
8	.2438	18	.0164
9	.2396	19	.0042
10	.2313	20	.0007

It will have been noticed that the tabulations in this paper from the company's experience have been given by amounts and not by lives or policies. This method was rendered necessary by the small number of actual deaths and the irregular incidence by age: thus in 1920 and 1921 the actual deaths were only 29 and 34 respectively, not sufficient to give any reliable results age by age, though ample for results at all ages as to actual number of deaths. While it was imperative to exhibit the age by age experience by amounts it was quite possible to compile the ratio of number of deaths to exposures year by year at all ages and this is given in the following table:

RATIO OF DEATHS TO EXPOSED BY POLICIES

Year	Number Exposed	Number of Deaths	Ratio of Deaths to Exposed	Deaths Per 1,000
1909	210	2	.009524	9.52
1910	2,079	0	0	0
1911	3,967	2	.000504	.50
1912	7,052	0	0	0
1913	10,190	9	.000883	.88
1914	12,872	13	.001010	1.01
1915	16,337	14	.000857	.86
1916	17,671	11	.000622	.62
1917	20,603	15	.000728	.73
1918	23,960	17	.000710	.71
1919	29,925	23	.000741	.74
1920	36,426	29	.000796	.80
1921	37,074	34	.000917	.92
Total	218,366	169	.000774	.77
Totals for the the years 1916–1921 inclusive	165,659	129	.000779	.78

This table shows an inclusive cost for all years from 1909 to 1921 and for all ages of 77 cents per thousand, and when compared with the cost from the total claims and total exposures by amounts in this paper is considerably lower. This is accounted for by the claims, of comparatively small number, having been for amounts largely divergent from the average amount per policy, but this actual figure over the whole period of 77 cents per thousand does, when compared with the premiums deduced, demonstrate that the figures used in the deduction of the expected or probable deaths from accident provide amply for the actual claims over these twelve years at all ages and for all individual amounts.

DISCUSSION

Mr. James E. Flanigan: When asked to discuss Mr. Webb's paper I happened to have an experience of our own that I had drawn off for our company right after the first of the year. I have not really had time to study his paper enough to discuss it intelligently and am offering this experience of ours as a discussion.

I might say that before we put out the double indemnity benefit, which was before October 1, 1918, I wanted to get some idea of the crude accident rates from our life business by ages before adopting any definite standard of rate. At that time we had about two hundred and fifty million of business in force, had had for the past few years, which was already tabulated by attained ages so that it was very easy to get the exposure by ages. I just simply had to go through the death losses for a few years back and tabulate the losses by age groups, and I put them in groups of ten years. I found a steadily rising cost for accidental deaths with each age group as the age increased. As I remember, it started with about 60 cents a thousand net and ran up to a little over a dollar at age 80. We decided, on putting out the benefit, to adopt a flat gross rate of a dollar a thousand, limiting the benefit to age 60, cutting it off at age 60.

I might also say that our company sells about 70 per cent of its business on the life at age 70 basis so that virtually all this experience is on an ordinary life basis.

About October 1, 1918, the Bankers Life Company started to issue double indemnity benefits in connection with its life insurance contracts. It may be of interest to the members of the Institute to know the experience of the company upon this business.

Clause.—The clause used was the usual double indemnity clause, the benefit not to apply if the insured's death resulted from self-destruction, whether sane or insane, or from any violation of the law by the insured, or from military or naval service in time of war, or from a state of war, riot, or insurrection, or from engaging in submarine or aeronautic operations, or while outside the continental limits of the United States and Canada, or from physical or mental infirmity, or directly or indirectly from disease of any kind.

The benefit was not written beyond age 55 and expired at rated age 60. The clause provided that death must occur within 60 days after sustaining the injury, in order to have the double indemnity effective.

Rates.—The basic rate charged was $1.00 per thousand, which applied to ordinary life, life paid up at age 70, and all continuous premium endowment plans. An adjustment rate was charged upon the short limited-payment life and limited-payment endowment plans, which was found by dividing the annuity for the premium-paying period into an annuity for the same age running to age 60, with a rough graduation to make the rates run smoothly.

Certain types of risks were charged double the above rates where there was a well-defined accident hazard due to occupation, but where such hazard was not large enough to result in rating the risk on the life insurance, such as carpenters, brick-layers, etc. Applicants with a hernia were also charged the double rate.

Limits.—The company has at all times carried the double indemnity risk without reinsurance, treating it as an additional risk and carried separately from the life insurance. The limit of double indemnity issued was $10,000 until May 17, 1921. Since that time it has been $25,000. Cases requiring double rate are limited to $10,000, and female risks are limited to $5,000.

Experience.—

	Gross Earned Premiums	Losses Incurred	Percentage
1918–19..........	$ 16,986.88	$ 28,000.00	165.0
1920.............	58,844.98	38,872.34	66.0
1921.............	116,964.15	59,500.00	51.0
Total........	$192,796.01	$126,372.34	65.5

It can be seen from the above figures that the loss ratio has declined steadily. I believe this is due to two causes; namely, that the heavy loss rate shown in the early period of the experience was due to fluctuation because of paucity of data, and the fact that the underwriting methods have improved with our experience.

Most of the double indemnity agreements have a clause specifying that the insured must die within 90 days of the date of the accident. It will be noted that the agreement used by the Bankers Life Company has a 60-day clause instead of 90 days. I inquired of the Claim Department regarding this feature and find that up to date we have not had a single inquiry regarding a claim where death resulted from accident between 60 and 90 days after the date of the accident, so that apparently the number of claims saved by use of a 60-day clause will be small.

Expenses.—At the time we decided to issue the benefit, one of the most important questions raised was as to whether commissions would be paid or not upon the double indemnity premium and, if so, at what rates. It was finally decided to pay the regular life commission, both first year and renewal, and such has been our practice, the theory being that a much larger proportion of the life insurance issued would include the double indemnity benefit with a consequent lessening of selection against the company. I believe the results have justified our action.

There were various plans on which we did not issue the double indemnity, such as term, joint life, etc. On business issued which was eligible for the double indemnity benefit, about 85 per cent has included such benefit. The company operates upon the New York standard of commissions, and it was expected that the losses and expenses in the first few years of the experience would be considerably more than the gross earned premiums. It is expected, however, that, when we have been writing the business for a long enough period to have a proper relation between the renewal premiums and first-year premiums, the entire expense rate, including the home office expense, should not be over 25 or 30 per cent of the entire premium income. Thus, we figured that, if we could have a loss ratio of not more than 70 to 75 per cent of the gross earned premiums, we would not lose any money upon the benefit.

Losses.—I believe the loss ratio shown for the year 1921 was probably more favorable than a longer and larger experience would show. The gross earned premiums shown in the experience above were calculated upon the assumption that half of the current gross premiums had been earned as of December 31. This method introduces a slight error in the case of the short limited-payment life plans. As a very small proportion of this company's business, however, is done upon such forms, the error is negligible; and on the other hand, it must be remembered that there was considerable exposure at the close of the year 1921 during the days of grace where premiums were not collected until after the first of the year.

The following table shows the gross claims incurred:

1918–1919	$ 29,500.00
1920	41,500.00
1921	59,500.00
Total	$130,500.00

These figures for the years 1918 to 1920 inclusive differ somewhat from the losses incurred as shown in the experience, due to the fact that several cases were compromised. One $5,000 case, death resulting from gun-shot wound, was settled for $3,500, and one drowning case of $5,000 was settled for $2,372.34. In both of these cases the company was satisfied that death was actually due to suicide and not to accidental means. There were two other deaths as a result of gun-shot wounds—one for $10,000 and one for $2,500, which were paid in full, where the company was strongly of the belief that death resulted from suicide. They were cases, however, where it was felt that the chance of a successful defense by the company was almost negligible, and consequently the claims were paid.

It will thus be seen that the losses incurred include $18,372.34 of claims which were probably due to suicide, or roughly 15 per cent of the losses incurred. Much thought was given this factor before the company decided to issue the double indemnity benefit, as we were quite certain that we would have a number of such claims which we could not avoid paying. It might be mentioned that we make a special investigation of all cases where the circumstances point to suicide.

The following table shows the number of policies and the amounts actually paid by cause of death:

Number of Policies	Amount Paid	Cause of Death
11	$ 36,500.00	Auto accident
1	5,000.00	Tractor
7	21,872.34	Drowning
8	33,000.00	Gun shot
1	5,000.00	Street-car accident
9	25,000.00	Miscellaneous
37	$126,372.34	

It seems to the writer that the most outstanding feature of this table is the large proportion of claims from gun-shot wounds, and, as will be noted from the above remarks, this is largely due to the fact that those who probably committed suicide used this method in three of the four questionable cases, and, it must be acknowledged that in such cases it is most difficult to prove suicide even though the indications point strongly that way.

Deaths resulting from automobiles being hit by trains are treated as automobile accidents.

It is the writer's opinion that a company paying regular commissions on the double indemnity benefit will fare as well financially as the company which pays no commissions because of the consequent lower loss ratio.

I also wish to add a word of caution to those connected with smaller companies. As the loss rate will depend somewhat upon the agency organization, the underwriting methods, and the facilities for investigating claims, it is my opinion that the smaller the company the heavier the loss rate will be, unless it is extremely well handled.

Calvert F. Stein: Double indemnity benefits in connection with policies of life insurance is a subject which may well merit our most earnest thought and careful study, especially those phases of it to which Mr. Webb refers in his paper.

The Institute should feel indebted to Mr. Webb for giving us the benefit of the experience of his company with respect to double indemnity benefits.

All of us who have endeavored to make a study of this subject have met with the same disappointment as has Mr. Webb with respect to the experience of accident companies.

It is a matter of regret that the accident companies, with perhaps rare exceptions, did not attempt until recently to keep their accident experience segregated either by age or according to the various benefits granted.

Heretofore accident companies have stated their experience as a ratio between premiums received and losses paid without any regard to exposed to risk and have included in premiums received and losses paid not only accidental death benefits but weekly indemnity as well, so that the experience of many of the accident companies has been of little value to life companies in connection with double indemnity benefits.

In the last year or more, however, a uniform system for securing the relation of losses paid to exposed to risk and of segregating the experience according to the various benefits has been adopted by many of the accident companies, and it is to be hoped that much information of value to life companies may be obtained from this source in the future.

Mr. Webb states in his paper that he is giving the probability of death from accident at all ages from 15 to 65, though in the table the minimum age given is 20.

Mr. Webb explains this by stating that the practical age limit has been 20, though a few were accepted between 15 and 20.

It is a matter of regret that he was not able to give some data as to the experience in the "teen" ages, especially as many companies seem to be extending their age limit for double indemnity benefits to age 15, notwithstanding the statement which has been made from several sources that the rate of accidental death in the "teen" ages is considerably higher than at ages around 30.

The census returns of the United States Bureau of Statistics, however, do not seem to bear out these statements, and it would have been interesting to have an experience at the "teen" ages for our future guidance, if it could have been obtained.

It is also to be regretted that it was not possible, as Mr. Webb states, due to the relatively small number of accidental deaths, to give more in detail the experience of his company by lives rather than by amounts.

In Volume II, Part II, of the *Proceedings of the Casualty Actuarial Society*, Mr. Louis I. Dublin, of the Metropolitan Life Insurance Company, has given some interesting statistics with respect to the rate of death from accident, suicide and homicide excluded, for the period 1911–14, under the industrial policies of that company. This experience shows the following results:

MORTALITY FROM ACCIDENTS CLASSIFIED BY COLOR, SEX, AND AGE PERIOD

DEATH-RATES PER 100,000 LIVING, 1911–1914

(Experience of Metropolitan Life Insurance Company, Industrial Department)

Age Period	Persons	White Male	White Female	Colored Male	Colored Female
All ages	74.5	118.0	37.4	124.5	39.4
Under 5	97.1	104.6	82.6	150.8	126.5
5–9	51.1	68.1	31.9	68.6	52.4
10–14	41.0	64.3	14.5	81.8	24.1
15–19	53.0	86.3	15.2	136.3	14.6
20–24	55 7	100.0	15.8	111.5	28.0
25–34	59.7	117.8	16.0	123.2	22.0
35–44	74.9	160.3	20.2	129.7	30.6
45–54	98.8	197.8	39.2	146.2	44.7
55–64	141.9	253.1	78.2	177.4	53.9
65–74	260.5	354.3	209.7	281.6	164.2
75 and over	482.2	486.3	497.6	308.0	401.9

Of course, these figures include, as indicated, all ages and all occupations, but whether these factors are sufficient to increase the rate over that shown by Mr. Webb is not easy to determine.

It would seem, however, that Mr. Webb's assumption as to the rate of accidental death, so far as his company is concerned, is approximately correct, especially in the more recent years when the volume exposed to risk was sufficiently large to give an adequate experience.

In using Mr. Webb's assumed rate of accidental death and the net premiums derived therefrom, there are several factors which should be taken into account by companies contemplating making use of these figures.

In the first place, the benefits granted under the double indemnity provision vary with different companies.

Mr. Webb's company, in common with many of the western and southern companies, grant such benefits only during the premium-paying period of the policy, so that he is eliminating from his experience, in the case of limited-payment life policies at least, many risks before they shall have attained the older ages, when the rate of death from accident is considerable, as shown by Mr. Webb's figures for the older ages, and as most other statistics upon this subject have shown.

Most of the eastern companies, on the other hand, continue the benefits beyond the premium-paying period and until the assured has reached a definite age, usually 70, so that the net rate applicable to such companies, in the case of limited-payment life policies at least, would be materially increased.

In the second place, the methods of underwriting applied in the granting of double indemnity benefits would be reflected in the experience of any particular company.

These benefits are comparatively new with most companies, and there is no uniform, well-defined method of underwriting with respect to them.

Mr. Webb does not make any definite statement with respect to the methods followed by his company in connection with double indemnity benefits.

Many companies state that double indemnity benefits will be granted to all those whose occupations are rated by accident companies as "ordinary" or better. This does not seem a very satisfactory method to be followed.

There are a number of occupations rated by the accident companies, because of the weekly indemnity hazard, higher than "ordinary" which might very properly be granted double indemnity benefits; while there are, on the other hand, a number of occupations rated by the accident companies as "ordinary" or better, such as a number in railroad service, which should not perhaps be granted double indemnity benefits; so that in analyzing the experience of any company, its methods of underwriting with respect to double indemnity benefits should be considered.

Then, in the third place, the geographical limits of its business should enter into consideration.

The census returns of the United States Bureau of Statistics, for the year 1919, which are the latest available, show a rate of death from external causes, suicide excepted, per 100,000 of population, as follows:

Montana	102.5	Wisconsin	54.9
California	97.1	North Carolina	60.3
Pennsylvania	94.7	Kentucky	64.3
Florida	93.1	New Hampshire	65.1
Washington	92.9	Missouri	66.5

While these figures include persons at all ages, male and female, white and black, yet they give a comparison at least of the five states ranking highest and the five ranking lowest and show a wide difference.

It would seem, therefore, that the territory over which any company's business is distributed should be taken into account.

Now as to the method of valuation of double indemnity benefits. Mr. Webb states that he is of the opinion that the practical plan is to treat the business as yearly renewable and not to attempt an accumulative reserve from year to year. I am fully in accord with Mr. Webb in this opinion, though it seems to me his statement should be modified in one respect.

Those of us whose companies grant double indemnity benefits beyond the premium-paying period of a policy should, in addition to the usual reserve of 50 per cent of the premium required under yearly renewable accident contracts, set up as an additional reserve, in the case of limited-payment life policies, an annuity reserve, equivalent to the excess of the premium required under limited-payment life contracts, when the benefits continue beyond the premium-paying period, over the premium required in the case of whole life or endowment policies, where the benefits discontinue with the premium payments.

While discussing the subject of double indemnity benefits it may not be out of place to call attention to one increasing hazard which is referred to by the United States Bureau of Statistics, and that is the increase in the rate of death from automobile accidents.

According to the census returns the death-rate per 100,000 of population from this cause for various years is, as follows:

1906–1910	1.0
1911–1915	3.9
1916	7.3
1917	9.0
1918	9.3
1919	9.4

While this experience includes all ages, and the death-rate among children from this cause is considerable, and while an increase would naturally be expected with the increase in the number of automobiles in use, yet it is a factor to be reckoned with in connection with double indemnity benefits or any other accident coverage.

Mr. Webb has given us in his paper much food for thought, and it is to be hoped that others will, from time to time, as the experience of their companies would seem to warrant, give us the benefit of such experience, for in this way only can we arrive at adequate rates for double indemnity benefits, which have become an integral part of life insurance contracts.

I might say that our company has been making a study of automobile accidents and we find that as the condition of roadways improves in a number of states the number of accidents increase. We assume from that that as soon as roadways are improved speeding is increased.

MR. DUNN: I would like to ask Mr. Webb if his company's risks are predominantly agricultural or whether they are urban.

PRESIDENT GRAHAM: Mr. Webb will perhaps answer that when he closes the discussion.

MR. FRANKLIN B. MEAD: Mr. Webb is to be congratulated upon so closely forecasting his subsequent experience. I believe he is also to be congratulated in subsequently adopting the same premium rates for all ages. I can't see the advantage where it evidently so closely coincides from age to age of making a distinction for the various ages. At the same time it is interesting to have a compilation of the actual mortality on double indemnity and actual policies from age to age. Therefore, it is to be regretted that Mr. Webb did not in his tables also put down the actual claims at the various ages. I can't see the advantage of having detailed this from age to age without also having put down the corresponding claims. I hope before the paper is printed that might be done, that the actual claims by age may be incorporated.

In the context it states that the figures for the years prior to the year 1916 were too irregular and included insufficient exposures to be of any value for an age to age exhibit. I do not quite see the consistency of that remark and then not having included the actual claims for the various ages as they occurred.

Looking at the "Probability of Death," which I presume to be but one per thousand on the average, and also on the last page of the paper, down in the summary of the general tables, it is noted that the percentage of actual to expected was 99.82 per cent; although Mr. Webb has not stated in the paper, evidently the claims based on amount were somewhat in excess of one dollar. Toward the close of his paper he has given the claims as 77 cents, by policies, but the claims evidently by amounts were very much heavier. It would be interesting to have him give us the actual figures in dollars and cents on the basis of amounts because that is what we are principally interested in.

This experience seems to have coincided with the experience of the State Life which was given us several years ago by Mr. Beckett. I believe the claims at that time were about a little under 90 cents a thousand. It will be noted that there is considerable possibility of fluctuation. Mr. Flanigan has just stated that the claims in his company were about 65 cents. I believe that closely coincides with the Medico-Actuarial Investigation where the claims were based on amounts. I am therefore surprised—those are based on amounts. The experience of the Medico-Actuarial was in connection with policies providing life insurance—that the rate of it was so low. We expect that where we have double idemnity benefits there will be many types of claims that will come in as accidents which under regular life policies would come in under some disease or something else.

Possibly the difference in the experience of the Kansas City Life and that of the bankers may be due to the large amount of business west of the Mississippi River. It is practically all of it west of the Mississippi River, and, as we all know, the death rate from accidents is much greater west of the Mississippi River than it is east of the Mississippi River in the same type of occupation. Of course, in his paper it is stated: "It will have been noticed that the tabulations in this paper from the company's experience have been given by amounts and not by lives or policies. This method was rendered necessary by the small number of actual deaths and the irregular incidence by age." I can't see what was gained by giving it by amounts. If the data was too small it seems to me that the data in effect is not increased when you consider the policies by amounts as compared with taking it on lives. You are merely multiplying the same data by a constant that is not involved in the probabilities. It would be interesting to have Mr. Webb explain just what he meant by that statement.

MR. JOHN M. LAIRD: The part of this paper which I enjoy most is the subtle compliment to the Travelers Insurance Company in the section where the author in effect says: "In spite of the fact that the figures were meager and were published by the Travelers Insurance Company, nevertheless I did not disdain to use them."

In preparing his accidental death rates twelve years ago, it was natural that Mr. Webb should use the American Experience Table but now it is known that the actual mortality at ages under 55 is considerably less than the rate shown by the American Experience Table. If, therefore, the method outlined in this paper is to be followed in the future, it may be advisable to readjust the figures on the basis of a modern mortality table such as the American Men.

The author's original calculations give almost a flat rate of accidental death regardless of age but his actual experience in the form in which it is now published does not indicate whether the rate of accidental death is level or varies with attained age.

Other sources of information indicate that the rate of accidental deaths probably increases at the older ages. Mr. Louis I. Dublin, Statistician of the Metropolitan Life Insurance Company, recently published some statistics showing the death rate among industrial policyholders by attained age in the period 1916 to 1920. The industrial experience on accidental deaths shows a high rate at age 17, a low point at age 30, and then a gradual increase. The net premiums per $1,000 for a one-year term policy on the industrial experience are approximately:

Age	Premium
17	$ .60
30	.50
40	.60
50	.80
60	1.20
70	2.70

Although the experience on ordinary insurance may differ from industrial insurance still it is reasonable to suppose that a similar increase with attained age will be found. If the actual mortality increases at this rate, then we should carry as a reserve more than one-half of the one-year term net premium, particularly on policies where the accidental death benefit is continued to age 65 or 70.

It would be interesting to know what Mr. Webb considers "standard risks" for the accidental death benefit. For instance, farmers are considered excellent risks for life insurance but are sometimes rated up for accidental death benefits. On commercial accident insurance farmers have shown a high rate not only of disability but also of accidental death. If, therefore, Mr. Webb's experience includes a large proportion of farmers, his accidental death rate may differ from that of another company issuing a much higher proportion of its insurance to business and professional men.

C. H. Beckett: Mr. Webb obtains a "q_x" column showing the probability of accidental death, first, by finding the probability that a death having occurred was due to accident, and then applying these factors to the American Experience Table. It occurs to me that a presentation of the death-rates derived directly from the original data would be of more interest. A "q_x" column constructed more directly from the original data, though less refined, would probably be of more value.

After calculating the expected accidental death loss by age groups, Mr. Webb compares the total accidental death loss with the total expected and makes the statement, "I believe the exposures during these years have been sufficiently great to warrant the plea, that my original calculation of the probabilities of death from accident are substantiated by the result as soon as the exposures arrive at a magnitude which practically forbids the influence of locality and occupational hazard."

This is true in respect to the business as a whole, but proves nothing in regard to the accidental death hazard for the various age groups, which is important, and was the original point of interest in Mr. Webb's paper. As far as final results are concerned, the more or less common assumption of a flat accidental death strain of one dollar per thousand would have even more closely approximated the actual.

The following table showing the experience of the State Life is of considerable interest, especially in connection with the last table in Mr. Webb's paper. You will notice that, although prepared in entirely different ways, the exposure is very similar; and although the death-rates for the individual years show no similarity whatsoever, the final results are identical.

DOUBLE INDEMNITY EXPERIENCE

(The State Life Insurance Company)

Year	Mean Amount in Force	Death Claims	Claims per 1,000 Mean Amount in Force
1908	2,163.206	1,000	.46
1909	6,883.138	250	.03
1910	12,396,872	22,000	1.77
1911	16,546,951	12,000	.73
1912	19,481,551	20,403	1.05
1913	22,015,584	28,766.19	1.31
1914	24,710,290	28,877.33	1.17
1915	26,721,965	5,790.62	.22
1916	30,242,253	20,850	.69
1917	34,842,144	6,658.81	.19
1918	39,466,523	21,000	.53
1919	50,558,111	73,750	1.46
1920	69,623,908	61,500	.88
1921	80,268,729	36,000	.45
Total	435,921,225	338,845.95	.78

Mr. Glover: I wish to remark on the point brought out about the difficulty of getting satisfactory data on double indemnity.

You will notice that Mr. Webb got his data from the mortality statistics published annually by the Bureau of the Census and his actual experience was 99.82, just 18 per cent from the expected. I wish to use this illustration to call attention to valuable data available to actuaries published by the Bureau of the Census.

Now let us see how it would be valuable to us. In the first place, in the case of accidental death there is no ambiguity. We know when a man is killed by an automobile or run over by a train.

Furthermore, it has been remarked that the rates are different in different states. We can get them by age in the individual states, for example, in Michigan, in Illinois, in New York. We can also get the rate in the country by age, or in the city by age—in fact, we can get the statistics far more extensively than from records of life insurance companies for many years. Of course, I recognize when using these statistics we must give due consideration to the obvious differences between the risks of life companies and the general population.

Mr. James E. Flanigan: May I make just another remark or two? The question of farmers has been brought up in the discussion here. I want to state that Mr. Laird's remarks are the first real authentic figures I have heard with reference to the accidental death rate among farmers. A priori reasoning, I never could see why there should be a heavy death rate among farmers. When we established the double indemnity benefit we sold it very freely to farmers at a dollar, except where we found they were doing coal mining or something of that sort. The great bulk of our business has been among farmers. So that I can't see where the large death rate among farmers comes from in actual experience.

There was another point mentioned about reserves. One of the speakers, Mr. Stein, I believe, mentioned that reserves should be larger on the limited payment policies where the benefits are payable through life. Of course, we all recognize that. On the other hand, I think that the 50 per cent of the premium on the unearned reserve of the policies is too high, if your premiums are adequate, because it makes no allowance for expense which has already been paid.

Mr. Charles H. Beckett: May I take just another moment to make a suggestion? I made a very careful examination of accidental deaths in our company over a period of twenty-eight years. I find that the accidental death rate is considerably higher than the death rate in connection with double indemnity policies. The question has been asked many times, if you can grant double indemnity why can't you grant it freely. If our double indemnity benefit had been issued on all the policies it would have cost considerably over $1.00 per thousand.

Mr. Flanigan: I am inclined to think that there may be quite a difference in the accidental death rate among farmers, if it is written strictly for accidental policies and if it is written in connection with life policies. I think the selection might be different.

Mr. Mead: Eight or ten years ago I saw some statistics as to accidental death according to occupation. I saw the accidental death rate on farmers was three or four times what it was on clerks.

President Graham: What statistics were those, Mr. Mead?

Mr. Mead: The census statistics.

Mr. Glover: What year?

Mr. Mead: About 1908. The death rate on farmers was three to four times heavier than it was on clerical occupations.

Mr. Glover: Where was that?

Mr. Mead: In the United States.

Mr. Glover: In the registration area?

Mr. Mead: In the registration area, yes.

Mr. Webb: There were several rather interesting questions brought up in the discussion. I am not taking these questions exactly in the order they were asked. I am taking them in the order they occur to me. About the first one is in regard to the question of farmers.

All through this paper I have tried to make it very plain that this was a submission to you of facts and I can only tell you as another fact for which I have no explanation, that this experience together with the ordinary life experience of which it was a part was about 80 per cent among the agricultural population of the states over which the business was written. The double indemnity addition was given quite as freely to all policyholders if they were eligible for insurance. There was practically no line drawn on occupations. If a man was eligible for an ordinary policy, I mean a twenty payment policy, about 80 per cent of the business being written on that plan, why, then he was also given the D.I. I probably should have said that the D.I. has been uniformily restricted to $10,000 through the whole of the experience covered here. All of which I think adds to the value, such as it is, of the paper—uniformity all the way through. The benefit has been limited, as I say, to $10,000 and to twenty years, or the shorter premium paying periods.

Of course, it will cover people over 60 in the comparatively few cases where insurance has been granted over age 60, and we add the D.I. benefit just as freely or even more freely than we would at the ages between 40 and 50 because the experience is so close to what I assumed and the rates were lower at the older ages, but the actual business of the company covers so few people over 50 that it is really negligible.

The question Mr. Mead brings up as to why I did not exhibit the figures age by age or year by year by policies is this: I had two reasons for simply putting in the amounts. The figures were larger, larger figures, actual figures in amount, and more readily read.

Another reason was that in some of the earlier years the actual number of deaths was extremely small. In one year I believe we only had two claims each for the maximum of $10,000. An exhibit by actual ages and policies would have shown an occasional one down a whole column of ages.

There was a slight error in the printing with regard to that decimal point which I believe we will have an opportunity of correcting before finally going to press. I have not been asked to proofread these galleys.

I can't recall any other questions except to say generally that I did not—I purposely refrained from going into any explanation that I might have thought accounted for the figures. I wanted to present the actual facts straight from the records as they were. I put them in the form that appealed to me as most suitable. Of course, I am open, as ever, to correction. Occasionally I am open to changing my mind—not very often. I am endowed with a certain amount of that quality which I believe when it occurs among the natives of this country is called determination, and when it occurs among the natives of the country that I am proud to belong to, it is called pig-headedness and sometimes bullheadedness, but whatever it is, there it is. But anything, really, that you may think or consider an improvement in the way in which the figures have been set out I shall be awfully glad to make the change, but, of course, the figures themselves I cannot change because they are the actual facts.

The question of territory which was brought up, I have said, has been practically the same throughout. The company has not changed the general nature of the territory over which this experience was taken. It comprises practically the Middle West; no really southern states, no northern states whatever, no state east of the Mississippi River, because the company is only in one state east of the Mississippi River and went into that state quite recently and writes an extremely small amount of business there. That is Illinois. But the territory covers eighteen of the Middle West states with a few of the northwestern states, with very, very small business there.

I think that practically covers it all except that I shall be very glad indeed to co-operate with Mr. Beckett so far as my original cards permit in making up a joint experience of this, for the reason that his results, I believe, in the main agree with my own and between us we would have a total exposure of pretty nearly—

MR. BECKETT: About a billion dollars.

MR. WEBB: Yes. And that ought to be sufficiently large to be of value. At the same time, the one and original object of writing this paper still stands and that is that the figures, such as they were, as taken by me as a basis eleven years ago, have been in this particular case borne out by the actual facts.

I want to say one more thing before I sit down and close this discussion, and that is to Mr. Laird. I did not use the Traveler's figures because they were meager and because they were the Traveler's, nor did I have any objection to doing so. I used the figures notwithstanding they were meager and because they were the Traveler's. (Laughter)

A REVIEW OF SOME OF THE EARLIER METHODS OF SURPLUS DISTRIBUTION, SOME PROPOSED METHODS, AND SOME METHODS CURRENTLY IN USE BY LIFE COMPANIES IN THE UNITED STATES

BY J. CHARLES RIETZ

It is not the purpose of the present paper to promulgate any new theories or even to discuss the merits of the various methods of surplus distribution. In so far as any opinion at all is expressed in regard to any method, it is done not in any dogmatic spirit but rather for the purpose of provoking, if possible, some discussion among the members of the institute. It is the purpose of the paper to put into concise form for the use of students some of the earlier methods, proposed methods, and methods currently in use in this country. From the nature of the paper and its purpose it is obvious that it contains nothing new or original with the writer.

For many years the sources of surplus of life insurance companies seemed to be shrouded in mystery and no attempt was made to distribute surplus with regard to its origin. The methods used were extremely arbitrary, the most common method being simply that of distributing the surplus in proportion to premiums paid since the last distribution. In some companies this was modified so that the surplus was distributed in proportion to the premiums paid since the last division, accumulated at compound interest to the date of distribution. In some companies the method of distributing in proportion to the loading was used. In others the basis of distribution was the loading less a constant for expenses.

So far as the writer is able to learn, the first scientific attempt to distribute surplus was the method proposed by Dr. Sprague and is known as "Sprague's Method." This method in its original form distributes the surplus in proportion to two factors, namely, reserve and premiums. The interest element of the dividend is arrived at by multiplying the reserve at the last distribution by the rate of interest actually earned, less the valuation rate compounded for the distribution period. Stated in symbols, $I_m=(i-i')^n\cdot V_{m-n}$ where m represents the number of years since the issue of the policy, n represents the number of years since the last distribution of surplus, i represents the rate of interest actually earned during the distribution period, and i' is the valuation rate of interest. After determining the total amount of surplus to be thus distributed on account of excess interest earnings, this total is deducted from the total surplus to be distributed and the balance is distributed in proportion to the premiums paid since the last distribution of surplus. This method of arriving at the interest element of the dividend when applied to annual dividends gives to each policy the benefit of the annual increase in reserves in the apportionment. In this respect the method appears to be equitable as applied to annual dividend policies but when applied to deferred dividend policies it is not clear that the method is equitable because excess interest earnings are based entirely upon the reserve at the beginning of the distribution period and does not take account of the annual increase in reserve. It seems to the writer that the method neglects the interest element earned on that portion of the premiums received during the distribution period which goes into the reserve.

Certain modifications of Dr. Sprague's method were introduced by British companies, the most important of which is a distribution of the second element of surplus in proportion to loadings instead of premiums. A method closely resembling Dr. Sprague's method with the modification mentioned is still in use by a number of American companies under the name of a "contribution" formula.

Another modification of Sprague's method was introduced by Mr. T. G. C. Brown and is known as "Brown's Method." Under Brown's modification the gains and losses are divided into three groups, namely: (1) Gain from loading, plus gains from surrenders and lapses; (2) gains from excess interest; (3) all other gains or losses including mortality gains.

The total gains or losses of the third group are prorated between the first two. The amount in the first group increased or decreased by its proportion of Group 3 is divided according to loading received during the distribution period. Group 2 increased or decreased by its proportionate share of Group 3 is divided according to the reserve value at the end of the distribution period. Dr. Sprague's method with various modifications was extensively used not only in Great Britain but also in Australia.

In a paper read before the Institute of Actuaries in 1892 (*J.I.A.*, Vol. XXX) by Mr. H. J. Rothery he says in support of the method: "The method in its simplest form divides the profits into two portions only, namely, 'Interest' and 'Loading' profit, and it seems to me that it is undesirable to attempt to carry the apportionment farther." In the same paper referring to the "Contribution" method he says: "I cannot help thinking that this attempt at refinement is unnecessary and involves an endless amount of labor."

Mr. David Carment in a paper which appears in the *Transactions of the Actuarial Society of America* says (in support of the method):

> The method in question is undoubtedly much simpler than the contribution method so much followed by American companies and as I have already stated, I believe it does substantial justice to the various members without attempting as the American plan proposes to do to analyze into all its component parts the profit earned by each policy. In this matter as in so many others connected with our business, we must remember that life insurance is after all essentially a question of averages; and that try as we may it is impossible to allot to every separate policy its precise share of expenses or its precise contribution of mortality. In order to carry out such a theory it would in fact be necessary to discriminate in the matter of expense, not merely in the policy of One Hundred Pounds or One Thousand Pounds but also between those for smaller amounts but effected under different tables as well as between those which had been effected with or without the intervention of a canvassing agent. In the matter of mortality again it would be necessary to treat differently the man living in New Zealand and a man living in Queensland, to say nothing of the difference in this respect between clergymen on the one hand and mariners on the other. This being so, it seems to me to be both unnecessary and undesirable in our allocation of surplus to aim at a degree of theoretical exactitude which is manifestly unattainable in practice.

For many years after the business of life insurance had been instituted in America no attempts were made at a scientific distribution of surplus. The history of the subject discloses that even up to 1860 American companies used the simplest and most arbitrary methods although the matter had already been the subject of much discussion in Great Britain. The apparent indifference of the early American actuaries in regard to the matter of surplus distribution was doubtless due to the fact that they were occupied with the more important question of American mortality and it was not known to a certainty whether a real surplus existed.

The first distribution of surplus attempted by an American company was by the New York Life. The first dividends were in the form of scrip, the face value of which was a percentage of the premiums and were redeemable at the pleasure of the board of trustees and bore interest until redeemed. The first of these were redeemed in 1861. The scrip method of apportioning dividends was used by the New York Life until 1868 when the "contribution" method was adopted.

The scrip method of declaring dividends with various modifications was followed for a time by practically all American companies. In some instances the date of redemption of the scrip was stipulated instead of being at the pleasure of the board of trustees; also, in some instances the scrip did not bear interest. Another modification of the scrip method consisted of making the face of the scrip a percentage of both the premiums and the reserves. In some companies which used the scrip methods the limited-payment life policies were given the same amount as ordinary whole life policies at the same age instead of the same percentage of the premiums. This method with the modifications mentioned illustrates how arbitrary were the methods in use. The fact which now stands out as astonishing in connection with these early methods is that in some instances the face of the scrip issued was as high as 85 per cent of the premiums paid and it was not unusual for them to run as high as fifty per cent of the premiums.

The Mutual Life Insurance Company of New York was the earliest American company to give the matter of surplus distribution serious consideration from a scientific standpoint. Its earlier dividends like those of other companies were on a percentage basis. However, in the early sixties the trustees of the Mutual Life conceded the unreasonableness of the percentage system and Mr. Sheppard Homans, then actuary of the company, was sent to England to study the subject and obtain the advice of English actuaries. Upon Mr. Homans' return it was decided to adopt what is known as the "Jellicoe" method. This method briefly stated consists in finding the premiums according to a mortality table based upon the company's own experience with the rate of interest actually earned by the company. The premiums thus computed are to be deducted from the actual premiums paid. After determining the excess of the actual premium over the "true" premium, each policy is then given a share of the surplus to be distributed in proportion to the excess premium thus determined. It is apparent that with a young company without an adequate mortality experience there would arise insurmountable difficulties in the application of this method. A decision was reached by the trustees to the effect that the new method was to go into effect February 1, 1863, but early in 1862 objections were urged against the method and Mr. Homans suggested the contribution method which was finally adopted instead of the Jellicoe method.

Inasmuch as the contribution method of distributing surplus in one form or another is used by practically every American company at the present time it seems that everyone interested in the subject of surplus distribution should be familiar with the history of the contribution method.

In 1863 Mr. Homans presented a paper before the Institute of Actuaries entitled "On the Equitable Distribution of Surplus." This paper contains a full description of the contribution method in its original form. The method provoked much discussion both in Great Britain and America. Perhaps the best source of information reflecting the opinions of insurance men in America concerning the relative merits of the percentage and contribution methods appears in the *Thirteenth Annual Report of the Insurance Commission of Massachusetts, 1868*. This discussion appears in the form of letters from various insurance men addressed to Mr. John E. Sanford, Insurance Commissioner of Massachusetts, in reply to a letter sent out by Mr. Sanford for the purpose of securing prevalent opinions of men prominent in insurance at that time concerning the important subject of surplus distribution.

Since the report mentioned above is not readily accessible to many students, it appears to the writer to be desirable to reprint in *The Record* of the American Institute Mr. Sanford's letter and some of the replies received. I have therefore ventured to incorporate some of these letters as a part of the present paper. The reply and mathematical demonstration given by Mr. Sheppard Homans, the originator of the method, is of especial interest because it gives the contribution method in practically the original form.

COMMONWEALTH OF MASSACHUSETTS

INSURANCE DEPARTMENT, BOSTON, November 1, 1867

MY DEAR SIR:—One of the most important questions, touching, at the present time, the practical management of the large interests of Life Insurance, is that of *the right mode of distributing surplus to the assured.*

The practice of the several Companies doing business in this State, and allowing the assured to participate in profits, appears now to be divided between what are known as the "Percentage" and the "Contribution" plans, respectively.

With a view to giving to the public the best light which can be had on the subject, I respectfully invite from you a discussion of the comparative merits and practicability of these or other plans, in the following aspects,—not intending, however, to limit the range of inquiry or argument which you may see fit to adopt:—

First.—As doing strict or mathematical justice to the assured.

Second.—As regards simplicity, and convenience of adoption and actual use by Life Insurance Companies.

Third.—As regards the practicability of substituting one plan for another already in use, having due regard to the rights of old nad new members, and to the good faith of the Company.

Fourth.—As tending in all points of view, present or future, to promote and guard the rights and interests of policy-holders, and the strength and stability of the Company.

Fifth.—You will please embody in your reply, if the "Contribution" plan is recommended, the rules, methods and mathematical formulas necessary or most convenient for its practical application, in such form, and with such explanations as will make them intelligible to practical mathematicians.

Should you do me the favor to respond to this invitation, it is perhaps proper to say, that I should feel at liberty to make such use of your views, in connection with my next Annual Report, or otherwise, as may seem to me best to subserve the interests of the public.

I am, very respectfully, your obedient Servant,

JOHN E. SANFORD, *Insurance Commissioner.*

To the Actuary or other Officer of the ....Life Insurance Company.

REPLY OF LUCIUS McADAM

GUARDIAN MUTUAL LIFE INS. CO., 102 BROADWAY,
NEW YORK, December 27th, 1867

HON. JOHN E. SANFORD, *Insurance Commissioner*

Dear Sir:—Your circular in reference to the best mode of distributing surplus, was duly received, and I take this opportunity of giving you my views, which are entirely in favor of the Contribution system, so called.

The Contribution system is less a "device" than a discovery, or development of truth. It takes its place by strict demonstration, in the general body of Life Insurance mathematics.

That each person participating in a distribution of surplus, should receive that part which he had contributed to form such surplus, is self-evident. and it only remains to ascertain what his contribution has been.

How is surplus formed? The premiums received by the company are accumulated by investment, but such accumulation is continually retarded or decreased by the claims by death, or otherwise. At the end of the year, the company has on hand a certain amount of money, part of which must be reserved, and the balance is surplus.

Now this general process of the whole company, is but the aggregation of the individual processes of each policy. The Contribution plan, therefore, credits each policy with the premiums paid upon it, and the accumulations from interest, and debits it with the risk or cost of insurance from year to year, and with the necessary reserve, returning the balance as dividend. It is thus a merit of the Contribution system of dividends, as of Wright's Accumulation formula for valuation, that it explains the whole operation of Life Insurance.

The mathematical argument, however, which, in truth, is the only proper one, is a complete vindication of the Contribution formula.

Mr. Homans has derived his formula directly from the value of a policy in terms of the D and N columns.

I insert here its derivation from Wright's Accumulation formula for such value of a policy, referring to his Life Reports, pp. 366 and 367, for a few points in the process.

$$H_{x+n+1}=u_{x+n}(H_{x+n}+\phi_x-c_{x+n})$$

But $u_{x+n}=\dfrac{r}{1-r\cdot c_{x+n}}$, which makes the above

$$H_{x+n+1}=\frac{r}{1-r\cdot c_{x+n}}(H_{x+n}+\phi_x-c_{x+n})$$

$$\text{Or, } H_{x+n+1}=\frac{r\cdot H_{x+n}+r\phi_x-r\cdot c_{x+n}}{1-r\cdot c_{x+n}}$$

Clearing of fractions, we have,

$$H_{x+n+1}-r\cdot c_{x+n}\cdot H_{x+n+1}=r\cdot H_{x+n}+r\phi_x-r\cdot c_{x+n}$$

Transposing,

$$H_{x+n+1}=r\cdot H_{x+n}+r\phi_x-r\cdot c_{x+n}+r\cdot c_{x+n}\cdot H_{x+n+1}$$

Or, $H_{x+n+1}=r\cdot H_{x+n}+r\phi_x-r\cdot c_{x+n}(1-H_{x+n+1})$

But $c_{x+n}=\frac{1}{r}\cdot\frac{d_{x+n}}{l_{x+n}}$

Whence, $H_{x+n+1}=r\cdot H_{x+n}+r\phi_x-\frac{d_{x+n}}{l_{x+n}}(1-H_{x+n+1})$

Adopting Mr. Homans' notation, H becomes R, $r=1+r$, and $\phi_x=p_x$. Hence,

$$R_{x+n+1}=R_{x+n}(1+r)+p_x(1+r)-\frac{d_{x+n}}{l_{x+n}}(1-R_{x+n+1})$$

Now, if we substitute the actual facts of experience, the second member of this equation becomes greater than the first (the value of the policy) by the amount of the surplus, which call χ_{x+n}. Also, $p_x=P_x-e$, $r=r'$, $d=d'$, and $l=l'$.

Hence the equation,

$$\chi_{x+n}+R_{x+n+1}=R_{x+n}(1+r')+(P_x-e)(1+r')-\frac{d'_{x+n}}{l'_{x+n}}(1-R_{x+n+1})$$

Transposing, we have the formula,

$$\chi_{x+n}=R_{x+n}(1+r)+(P_x-e)(1+r')-\frac{d'_{x+n}}{l'_{x+n}}(1-R_{x+n+1})-R_{x+n+1}$$

The fact that the formula can thus be deduced from other formulae, which all mathematicians admit to be correct, is sufficient to carry the mathematical argument.

I may add, in conclusion, that I approve of the Contribution formula for the reasons:

First. That it is mathematically correct, standing upon the same basis as a life premium or a reserve.

Second. That it is competent to deal with all classes of policies, and to adjust the smallest details of practice.

Third. From these two reasons, that it affords strict mathematical justice to the insured.

Fourth. That, with proper appliances and labor-saving contrivances, it may be made nearly as simple as any other, and as inexpensive.

Fifth. That it is easily understood,—more comprehensible than the Percentage system, which is inexplicable,—and that, properly explained, it gives a clear idea of the whole field of Life Insurance operations.

Yours respectfully,

LUCIUS MCADAM, *Actuary*

REPLY OF SHEPPARD HOMANS

THE MUTUAL LIFE INSURANCE COMPANY OF NEW YORK,
(Office corner of Broadway and Liberty Street.)
NEW YORK, March 13, 1868.

HON. JOHN E. SANFORD, *Insurance Commissioner, Boston, Mass.*

Dear Sir:—In accordance with the request contained in your circular, I have prepared the following explanation of the method of dividing surplus known as the "Contribution plan," and my reasons for preferring it to the "Percentage" or other methods of division heretofore adopted by life insurance companies.

In a *mutual* life company, the surplus belongs exclusively to the policy-holders or contributing members, and should be divided amongst them in an equitable manner. If we can ascertain the contribution to surplus, or *overpayment* by each person, an equitable distribution is thus made possible.

The contracts of a life insurance company cover a period in the future of many years, during which time there may be many and great fluctuations in the rates of interest and mortality, upon which the cost of insurance depend.

If we could foretell the precise mortality which would prevail amongst the members of a company, the precise rate of interest which would be derived from the investment of its funds, and also the precise cost of conducting the business, the premiums might be made just sufficient to meet the claims by death and office expenses—no more and no less. In this case there would be no distributions of surplus, since, if the premiums were exactly sufficient to provide for the liabilities, no surplus could arise.

We cannot look into the future, however, and hence the rates of mortality and interest assumed should be such as will be safe and prudent for many years to come. Such a margin or loading should also be added to the premiums, so deduced, as will be ample to guard against adverse contingencies, and provide for the office expenses. Hence, no company is entitled to the confidence of the community, or worthy the support of persons desiring to secure a *certain* provision for their survivors, which does not exact such rates of premium as will prove sufficient, under the most unfavorable conditions likely to be experienced, to provide for the payment of all claims as they mature.

In all American companies, the facts of experience, in regard both to interest and vitality, have *thus far* been more favorable than those assumed, or which it will be safe to assume for the future.

These actual facts of experience cannot be disregarded in the distribution of surplus, if we would observe justice and equity, any more than the *assumed* conditions of interest and mortality can be disregarded in deciding upon the rates of premium for insurance.

There are, in general, but three sources from which the surplus of a life insurance company can arise. First, interest higher than that assumed as a basis for determining the premiums. Second, mortality less than that called for by the tables on which the premiums are based. Third, that portion of the margin, or loading, added to the net premium, not required for expenses or contingencies. While these are not the only sources of gains to policy-holders, yet they are the principal, and are likely to be the abiding sources in the future. No distribution of surplus can be equitable, unless each source of surplus is carefully considered. Since the proportions of the surplus from each of the above sources differ widely on policies of the same amount, but issued at different ages, and on different conditions and terms, it follows that any *pro rata* distribution must of necessity be unjust.

For instance, the surplus arising from excess of interest should be divided amongst policy-holders in proportion to the amount of money in the hands of the company held on account of the several policies, or, in other words, in proportion to the *reserves* for reinsurance. Now, since these *reserves* depend not only upon the age at issue, terms and conditions of the insurance, and also of the payments, but increase in every case each year, it follows that the surplus from this source will be as variable as are the ages of the insured, or the terms and conditions of the policy. Hence, any attempt to divide this portion of the surplus in proportion to *premiums paid*, is simply absurd.

Again, surplus arising from greater *vitality* depends, not only upon the age of the person insured, but also upon the *amount actually at risk*, so that the surplus arising from this source varies also with the terms and conditions of the policy. Thus, as the *reserve* increases, the *amount at risk* diminishes, and the cost of insurance may, and in many cases actually does, decrease each year, notwithstanding the increased age of the insured.

By means of the "Contribution" plan, each source of surplus is separately and carefully considered, and the dividends are simply and solely *a restitution of surplus premiums* in the proportions overpaid by each person.

This plan was first introduced by the Mutual Life Insurance Company of New York, and is strictly correct in principle.[1] It is susceptible of being carried to the utmost degree of refinement, as well as of the most general application. Four dividends, or distributions of surplus premiums, have now been made by that Company upon this plan, and we see no reason to regret its adoption. It is simple, easily explained, popular with agents and with policy-holders, and, what is of more importance, is acknowledged, almost universally, to be just and equitable. However diversified the terms and conditions of insurance and of premiums, however varied the experience of a company in any or all respects, the Contribution plan enables us to do full justice to each policy-holder. Moreover, a company is left free to adopt new improvements, or to make any changes which experience may suggest, without injustice to present or future members. The facts of experience, however fluctuating, may be accurately and impartially applied, and made to correct, instead of perpetuate, any inequalities or errors inseparable from assumptions in regard to the future, upon which rates of premium, and indeed all insurance contracts, necessarily depend.

While the dividends upon the Contribution plan are comparatively moderate at first, as all dividends must be when based upon just and equitable principles, yet, with the same measure of prosperity, they increase each year, as the policy grows older, until, in time, the annual dividends may exceed the premium, leaving the insurance paid up in full.

The chief merit claimed for the Contribution plan of dividing surplus, is in the fact that the *equities* of all contributing members may be accurately estimated. When we remember the great variety in the terms and conditions of insurance in this country, and the magnitude of the interests already involved, this becomes a matter of great importance. And when we consider that life insurance in its present form, or with improved modifications, is at no distant day destined to absorb a large percentage of the surplus earnings of our whole population, the officers of our companies owe it to themselves, and to those who have intrusted such vast interests to their care, to make the system as perfect as possible, even at the expense of additional labor.

Very respectfully,

Your obedient servant,

SHEPPARD HOMANS, *Actuary*

---

[1] See Mathematical Demonstration and Formulas on succeeding pages.

MATHEMATICAL DEMONSTRATION

Of the Method adopted by the Mutual Life Insurance Company of New York for dividing the surplus among policy-holders in proportion to their individual overpayments or contributions to the surplus fund.

Let $(1+r)^n$ = The amount of $1, at the end of n years, according to the rate of interest on which the premiums are based, (generally 4 per cent.).

l_x, l_{x+n}, etc. = Numbers living at ages x, $x+n$, etc., according to the Table of Mortality from which the premiums are deduced.

d_x, d_{x+n}, etc. = Numbers dying annually at ages x, $x+n$, etc., out of the numbers living as above, according to the same Table.

p_x = The *net* annual premium at age x to insure $1, according to the Office Table as above.

P_x = The premium actually charged to insure $1.

R_{x+n} = The *Reserve* for re-insurance, or net value of a policy of $1, issued n years previously at the age of x, just before the payment of the premium then due.

R_{x+n+1} = The *Reserve* at the *end* of the year for the same policy.

χ_{x+n} = The Contribution to Surplus, or overpayment on a policy of $1 issued at age x, n years previously.

Let us now take the most simple case, namely, that of a company consisting of l_{x+n} persons, insured n years previously at the age of x for $1 each. Let us further suppose, for the sake of simplicity, that there are no expenses, that each person pays the net premium (p_x) only, that the net values of the policies are reserved, and that the rates of mortality and interest actually experienced are precisely the same as those indicated by the Office Table of Mortality.

The company then commences the year with an amount equal to the net value of the policies ($l_{x+n}\mathrm{R}_{x+n}$), and receives in advance the annual premiums on the same ($l_{x+n}p_x$), both of which sums are immediately invested at the rate of interest anticipated. In the course of the year there will be a certain number of deaths (d_{x+n}), on account of which the company will pay $1 each, and finally the company must have a sufficient fund at the end of the year to re-insure the remaining policies ($l_{x+n+1}\mathrm{R}_{x+n+1}$). If the premiums are correctly calculated, and the other conditions are fulfilled, it is evident that the funds will be just sufficient, no more and no less, to meet the obligations for the year. Hence we now obtain what may be called the *Equation of Equilibrium*, as follows:

$$l_{x+n}\mathrm{R}_{x+n}(1+r)+l_{x+n}p_x(1+r)=d_{x+n}+l_{x+n+1}\mathrm{R}_{x+n+1}$$

or, substituting for l_{x+n+1} its equivalent $l_{x+n}-d_{x+n}$, we have

$$l_{x+n}R_{x+n}(1+r)+l_{x+n}p_x(1+r)=d_{x+n}+(l_{x+n}-d_{x+n})R_{x+n+1}$$

or $$l_{x+n}R_{x+n}(1+r)+l_{x+n}p_x(1+r)=d_{x+n}(1-R_{x+n+1})+l_{x+n}R_{x+n+1}$$

Dividing now this last equation by l_{x+n}, the number living, and transposing, we have as the *Equation of Equitable Balance for Each Person*,

$$R_{x+n}(1+r)+p_x(1+r)-\frac{d_{x+n}}{l_{x+n}}(1-R_{x+n+1})-R_{x+n+1}=0$$

This equation may be deduced directly from the well known formula for finding the value of a policy. Thus, adopting the usual notation, and referring to the admirable paper by Mr. Peter Gray, "On the Construction and Use of Commutation Tables," in the *London Journal of the Institute of Actuaries*, Vol. X (a work which no life insurance company should be without), for more particular explanation and demonstration of each step in the argument, we have

$$R_{x+n}=A_{x+n}-p_x(1+a_{x+n})=\frac{M_{x+n}}{D_{x+n}}-p_x\frac{N_{x+n}}{D_{x+n}}$$

$$R_{x+n+1}=A_{x+n+1}-p_x(1+a_{x+n+1})=\frac{M_{x+n+1}}{D_{x+n+1}}-p_x\frac{N_{x+n+1}}{D_{x+n+1}}$$

Multiplying the first equation by $(1+r)=\frac{1}{v}$, we have

$$R_{x+n}(1+r)=\frac{M_{x+n}}{vD_{x+n}}-p_x\frac{N_{x+n}}{vD_{x+n}}$$

But $M_{x+n}=C_{x+n}+M_{x+n+1}$ (*Assur. Mag.*, vol. x., p. 95). Hence, multiplying by vD_{x+n}, we have

$$R_{x+n}(1+r)vD_{x+n}=C_{x+n}+M_{x+n+1}-p_xN_{x+n}$$

But $$R_{x+n+1}D_{x+n+1}=M_{x+n+1}-p_xN_{x+n+1}$$

Subtracting, we have, since $N_{x+n}-N_{x+n+1}=D_{x+n}$,

$$R_{x+n}(1+r)vD_{x+n}-R_{x+n+1}D_{x+n+1}=C_{x+n}-p_xD_{x+n}$$

But $D_{x+n+1}=vD_{x+n}-C_{x+n}$ (*Assur. Mag.*, p. 96).

Hence $R_{x+n}(1+r)vD_{x+n}-R_{x+n+1}(vD_{x+n}-C_{x+n})=C_{x+n}-p_xD_{x+n}$

Dividing by vD_{x+n}, we have, since

$$\frac{C_{x+n}}{vD_{x+n}}=\frac{d_{x+n}v^{x+n+1}}{vl_{x+n}v^{x+n}}=\frac{d_{x+n}}{l_{x+n}},$$

$$R_{x+n}(1+r)-R_{x+n+1}+\frac{d_{x+n}}{l_{x+n}}R_{x+n+1}=\frac{d_{x+n}}{l_{x+n}}-p_x(1+r)$$

or $$R_{x+n}(1+r)+p_x(1+r)-\frac{d_{x+n}}{l_{x+n}}(1-R_{x+n+1})-R_{x+n+1}=0$$

This last equation is susceptible of the most general application—by suitable modifications applying as well to the most complicated cases of survivorships, joint lives, etc., as to the most simple forms of paid-up insurance.

Let us now examine the practical application of this principle. Substituting in the equation the facts of actual experience for the theoretical assumptions, it is evident that if the former are more favorable than the latter, there will be *overpayments*, or *contributions* to the surplus fund, at the end of each year, and also that these overpayments or contributions will be affected by any departure from the theoretical assumptions, in reference to mortality, interest, etc. Adopting the same notation as before, with the addition of an *accent* to distinguish actual facts from theoretical assumptions, and representing the proportionate expenses by (e), we have the general *practical* equation,

$$R_{x+n}(1+r')+(P_x-e)(1+r')-\frac{d'_{x+n}}{l'_{x+n}}(1-R_{x+n+1})-R_{x+n+1}=\chi_{x+n}$$

$$=\textit{Contribution to Surplus.}$$

The equitable apportionment of the *expenses* of business among the various policy-holders, especially when the sum total of the *contributions* is greater than the total surplus to be divided, is a difficult and delicate problem, upon which no specific directions can be given—the peculiarities of each company requiring special treatment.

In the Mutual Life, the investments have yielded 7 per cent interest *net*, instead of 4 per cent, as was assumed—the mortality has been far less than was anticipated (although not equally so at all ages), while the miscellaneous profits have been sufficient to cancel the entire expenses of conducting the business. The overpayments or "contributions" in the case of each policy have been computed by means of the following formula, which we may call the *Equation of Equitable Distribution:*

$$R_{x+n}(1.07)+P_x(1.07)-\frac{d'_{x+n}}{l'_{x+n}}(1-R_{x+n+1})-R_{x+n+1}=\chi_{x+n}$$

Thus we see that each person derives the full benefit (to which he is surely entitled) from the excess of interest on *that portion of the assets of the company belonging to himself exclusively*, namely, *the value of his policy, the same having been reserved from his own previous payments.* This point, although of vital importance in an equitable distribution of surplus, is totally disregarded when the surplus is divided in proportion to premiums paid—in which case that portion of the surplus arising from excess of interest, belonging to policy-holders in widely different proportions, is divided amongst them all pro rata, to the manifest injury of those who have been longest insured. Since the miscellaneous profits have been sufficient to cancel all the expenses of business, we are enabled to credit each person with the full premium paid at 7 per cent interest [P_x (1 07)], without deduction for expenses. Finally, the results of experience have been carefully collated and studied, and a table, accurately adjusted, has been prepared, showing the actual rates of mortality at the several ages $\left(\frac{d'_{x+n}}{l'_{x+n}}\text{ etc.}\right)$, by means of which each person has been *assessed* for the payment of claims during the year, in proportion to the amount actually at risk upon his own life ($1-R_{x+n+1}$ for each dollar of insurance).

The dividend additions on all policies in this company also participate in the surplus as separate, paid-up insurances.

It is thus seen that, by the "Contribution" plan of division, not only is each *source* of surplus carefully considered, but any errors or inequalities in the rates of premium are at once detected and adjusted. It is now generally recognized by the best authorities as the only equitable plan of dividing surplus, and has already been adopted by many of the best American companies.

The same principle applies in determining the true measure of the interest of each person in the funds of a life insurance company. Thus the value of a policy on surrender has always been determined by deducting the present value of the future premiums from the present value of the sum assured. That is to say, the value of a policy has heretofore been considered the same as the reserve for re-insurance. The difference between what has well been called the *retrospective* and the *prospective* values, has been overlooked. The true value on surrender, or the true measure of the interest of a policy-holder in the funds of a company, is not correctly obtained by discounting the future, but by considering the actual facts of past experience. The difference between the amount, at compound interest, of the payments (less expenses) and the total cost of the insurance is evidently the *true* value of a policy. Thus, at the end of the first year,

$$(P_x-e)(1+r')-\frac{d'_{x+0}}{l'_{x+0}}(1-R_{x+1})=\chi_{x+1}+R_{x+1}=V_{x+1}$$

At the end of the *second* year, if the surplus of the first year has not been paid out, the value of the policy is

$$(P_x-e)(1+r')^2-\frac{d'_{x+0}}{l'_{x+0}}(1-R_{x+1})(1+r')+(P_x-e)(1+r')$$
$$-\frac{d'_{x+1}}{l'_{x+1}}(1-R_{x+2})=V_{x+2}=\chi_{x+1}(1+r')+\chi_{x+2}+R_{x+2}$$

The fact that the true value of a policy can only be thus determined, furnishes an additional argument for the adoption, by all companies, of the Contribution plan of dividing surplus.

SHEPPARD HOMANS, *Actuary*

REPLY OF DAVID PARKS FACKLER

Hon. JOHN E. SANFORD, *Insurance Commissioner of Massachusetts*

Dear Sir: In response to your Circular of Nov. 1, 1867, inviting a discussion of the comparative merits of the different methods of dividing surplus, I respectfully submit the following remarks on the points suggested therein:

1. "Strict or mathematical justice" may be considered in two aspects: First. Equity to policies of the same kind, but of longer or shorter standing. Second. Equity to different kinds of policies issued in the same year.

On the first, much has already been written, and but little more can be said. The Contribution plan gives the older members the surplus interest on the reserves accumulated from their payments, holding that being derived from them it belongs to them. The Percentage plan argues, on the other hand, that the oldest members are the poorest lives, the better having dropped off year by year, and that the greater mortality among them is a full offset to the gain from surplus interest.

To this it may be answered, that policies are not given up solely because the insured continue in good health, but far more generally because the payment of premium is inconvenient. Every practical insurance man has known of deaths just after the policies had been dropped. In fact, the poverty or business embarrassment that compels a man to discontinue, often kills him.

What statistics we have, indicate that the *better* lives remain. Table III, page 163 of the collected Massachusetts Reports, shows that the mortality among persons seventeen years after medical examination, was no greater than four years after, though the insured were so much older. Mr. Homans' investigations show the same experience in the "Mutual Life." It is true that the mortality increases during the first three years after medical examination, because the insured at the outset are all in good health, and it takes some time for sickness to begin to operate. It does not follow, howevei, that it continues to increase in the same way.

This argument on the score of increasing mortality, moreoever, scarcely applies to any other than "ordinary" whole-life policies, now a small part of the business. "Ten-payment" life policies, when changed to the paid-up form, are likely to remain in force on the good as well as on the impaired lives. Endowments, also, being taken somewhat as an investment, are not likely to be given up because good health continues.

Having considered the first aspect of this question, let us take up the second—*Equity to different kinds of policies issued in the same year.*

On the Percentage plan, no attempt is made to find what rightly belongs to the different classes of policies. It is settled off hand, and if afterwards it is thought that some kinds of policies receive more than proper, the remedy employed is either an arbitrary *decrease* of the dividend on them, or, what is worse, an arbitrary *increase of the premium*, so as to have more surplus to give back. In this latter way, the premium is based not on the Mortality Table, but on the prospective dividend to be made on it. Actuaries are asked to make rates sufficient for a fifty per cent. dividend. Premiums are made absurdly high, but the public mania for dividends is fed to the full. But I fear I am digressing.

When the dividend has to be decreased, it is made either an even lower percentage (on the actual premium), or the same in amount as on a corresponding whole-life policy. The latter method is quite inconsistent with the general principle of the Percentage plan, that the dividend should be proportionate to the premium paid, while it also gives more inequitable results, as we may see from this example.

The premium for an endowment-assurance policy payable in ten years, according to the tables of a company employing this rule, is $95.26 at age 30, and $103.32 at 50. The ordinary whole-life rates are $23.02 and $46.42 respectively. A 50 per cent dividend on these latter would give the endowments dividends of $11.51 and $23.21 respectively, which are entirely out of the proportion of the actual premiums. By the Contribution plan, the first dividends on these would be (supposing reserves on Actuaries' table 4 per cent, mortality three-fourths of that table, interest 7 per cent, and expenses paid by forfeitures) $15.97 and $20.97. I do not think that the warmest defender of the Percentage plan will deny that, in this case, the Contribution plan gives the proper dividend, and that the other makes one too high and the other too low.

Some companies, sensible to the general arbitrariness of the Percentage plan, have endeavored to attain equity as between life and endowment policies, by keeping separate accounts of their assets, receipts, etc.; but they cannot do justice by this merely technical classification, inasmuch as the endowments differ almost as much among themselves as the average of life and endowment policies do, some having only five, others forty years to run.

The Contribution plan obviates these difficulties and arbitrary settlements, by a straightforward calculation of the equitable share of every form of policy. It can, it is true, be dishonestly applied, but that is true of the Percentage plan also. The former may be made to give unfair results, the latter always does.

2. "Relative simplicity" is the next point suggested in your circular. The Percentage plan, like any "rule of thumb," has the advantage on this score. The application of the Contribution plan, however, is not so laborious as is generally supposed. The calculations require only moderate exactness, and do not have to be made separately for each policy; and, if an equitable division is worth anything, it is worth the slight extra cost involved in that method.

3. Your next point—the substitution of the Contribution for the Percentage plan in an old company, without injustice to any member or any breach of faith, seems to me perfectly practicable, though I cannot state any general rule for all possible cases.

4. Your fourth suggestion regards the relative *general expediency* of the different plans. In this aspect, the Contribution method is best, as it leads to a careful study of the sources and growth of surplus, and of the comparative gain from the different forms of policies; and, in this way, tends to ground the business on scientific estimates, instead of hasty surmises.

5. The application of the Contribution plan, I have remarked, is not as difficult as often supposed. The average mortality of a company is considered, not that of the insured of each age separately. Thus, if the probable number of deaths by the Mortality Table was 100, and the actual number 75, the cost of insurance at each age is assumed to have been three-fourths of that according to the table. This is, of course, not true of those recently insured, but, as the special expenses on their account have been very heavy, no practical injustice is done thereby. To avoid irregularity in the results for successive years, it is better for a small company not to base the calculations on the mortuary experience of each particular year, but on that of companies generally during a series of years.

The general rule to find the contribution of any policy during any year, on the hypothesis that the expenses have been paid by forfeitures and surrenders, is

To the reserve at the end of the previous year, add the annual premium, with interest on both for one year at the current rate. From this sum deduct the reserve required at the end of the year, *plus* the actual cost of insurance (the risk having been really for the amount of the policy, less the reserve held therefor.)

To express this algebraically, call

C_x^n, the contribution of a policy (issued at age x) for $1.00 during its n^{th} year.

R_x^n, the reserve at the end of the n^{th} year on the same.

M_{x+n-1}, the actual adjusted rate of mortality at age $x+n-1$.

P_x the annual premium for $1.00.

$1+i$, the amount of $1.00 at the current rate of interest.

Then $C_x^n=(R_x^{n-1}+P_x).(1+i)-[R_x^n+M_{x+n-1}(1-R_x^n)]$

For the contribution during the *second* year of an ordinary life policy, issued at age 40, with a premium of $31.47 per thousand—supposing the reserves made by the Actuaries' table at 4 per cent, the mortality at age 41 (age at beginning of 2d year) three-fourths of that by the same, and interest 7 per cent—we have

$$C_{40}^2=(.01441+.03147)\times 1.07-[.02931+.00796(1-.02931)]$$
$$=.04909-.03704=.01205.$$

A table of contributions formed on one hypothesis of mortality,—say three-fourths of the Actuaries'—can easily be corrected for any other proportion of the same table (that subsequent experience may recommend) without going over the whole calculation. For the mortality only affects one part of the equation, and the contribution on the basis of two-thirds of the above table, will plainly only differ from the last result by the quantity $(\frac{3}{4}-\frac{2}{3})$ of rate of age 41 multiplied by $(1-R_{40}^2)$, a correction which can easily be estimated and added to the former result.

When the actual mortality of the company is about the same as that of the table on which the reserves are based, a much more simple formula can be exployed, for then the surplus comes entirely from the "loading" in the premium and the excess of interest over 4 per cent so that, plainly, (p being the net premium).

$$C_x^n=(P-p)1.07+(R_x^{n-1}+p)\times .03$$

Having calculated the contributions of the separate policies, the next step is to find their sum for the whole company, which will be less than the actual surplus, unless the expenses have not been met by the gain from forfeitures, surrenders, etc. The excess, if any, may be divided either in proportion to the contributions or the premiums; but, for young companies, with premiums loaded evenly, the result would be nearly the same either way. By the former, calling the actual surplus

(S), the sum of the contributions (Σc), and the contribution on a particular policy (c), the dividend on it will be $\frac{S}{\Sigma c}c$.

To prevent any of the insured suspecting that they have been unfairly treated, or that any error has been made in their cases, it is well to publish a skeleton table of the actual dividends on the principal forms of policies for various ages and years of issue, by which all can see that their dividends are not exceptional.

D. PARKS FACKLER, *Consulting Actuary*

NEW YORK, May 2, 1868

An inspection of Mr. Homans' formula for determining the amount of surplus belonging to each policy discloses that it provides directly for only two sources of surplus for distribution, namely, excess interest on the effective initial reserve, that is, terminal reserve of the previous year plus the effective premium (gross premium less expense) and savings in mortality. It seems that it was Mr. Homans' idea that all miscellaneous profits should be applied toward expense, thus increasing the effective premium. That this was his idea, it seems to the writer, is brought out in his mathematical demonstration above where he says; "In the Mutual Life the investments have yielded 7 per cent interest net instead of 4 per cent as assumed, the mortality has been far less than was anticipated (although unequal at all ages), while the miscellaneous profits have been sufficient to cancel the entire expense of conducting the business."

Although the original contribution formula provided directly for only two factors in the dividends, yet it in effect provided for three factors, namely, excess interest on initial reserve, gain or loss from loading, and mortality savings. Although this is perhaps obvious from inspection, it may be demonstrated as follows:

Let P_x = Gross premium
p_x = Net premium
l = Loading

Then $P_x = p_x + l$

Substituting in the formula

$$R_{x+n}(1+r')+(P_x-e)(1+r')-\frac{d'_{x+n}}{l'_{x+n}}(1-R_{x+n+1})-R_{x+n+1}$$
$$=\chi_{x+n}=\text{Contribution to Surplus}$$

we have

$$\chi_{x+n}=(R_{x+n}+p_x)(1+r')+(l-e)(1+r')-\frac{d'_{x+n}}{l'_{x+n}}(1-R_{x+n+1})-R_{x+n+1}$$

In this form it is clear that the formula is in effect a three factor formula. The application of the formula in its original form would result in an addition to or deduction from the interest factor according as to whether there is a gain or loss from loading. It is worthy of note that the formula contemplates that the expenses be deducted from the loading at the beginning of the year and that the balances whether positive or negative be accumulated at interest, the amount augmenting or diminishing the dividends.

Mr. Homans' method has undergone many and varied modifications. It is unlikely that any company today applies the formula in its original form but opinion is practically unanimous that the contribution formula in its original form recognizes the sources of divisible surplus and the method in some form is now in use by nearly all participating companies in America. Instead of using a mortality table based upon the company's own experience with the rate of interest actually earned by the company as contemplated by Mr. Homans' formula, other procedures which accomplish the same end have been adopted. For example, the interest element of the dividend is often determined by taking a percentage of the reserve approximately equal to the difference between the rate earned by the company and likely to be maintained over a period of years and the valuation rate of interest. At this point too there is great variation among companies, some using the terminal reserves, some the mean reserves, and some the initial reserves for computing the excess interest to be apportioned. The mortality factor of the dividend is often taken as a percentage of the cost of insurance. In this matter there is also much variation, some companies using a flat percentage of the cost of insurance uniform at all ages, others a percentage graded according to attained age, age at issue, or duration of the policy.

A great many companies state that they use the "two factor" contribution formula. There is, however, a variation as to what is implied by the "two factor" contribution formula. Some companies who state that they use the two-factor contribution formula divide the surplus into two groups, namely, excess interest and all other, the mortality savings thus being merged with the gains or losses from loading, and miscellaneous gains. The dividends are then arrived at by taking a percentage of the reserve plus a portion of the loading. This method resembles more closely the loading modification of Sprague's method than it does Homans' original contribution method.

Other companies stating that they use the "two factor" method mean by this that they apportion interest as a per cent of the reserve and mortality savings as a percentage of the tabular cost, loading and miscellaneous gains being ignored altogether so far as the formula is concerned.

It is difficult for the writer to see the scientific justification for distributing mortality savings on the basis of loadings. After giving this matter some thought, the writer is forced to the conclusion that a justification of this procedure must rest upon one of two theories: (1) That savings in mortality constitute a relatively small element in the total gains and that the gains from loading constitute a relatively large element in the total gains and therefore mortality gains may incidentally be merged with the gains in loading and miscellaneous profits and be distributed in proportion to loadings. (2) That the primary and proper function of mortality margin is to meet the expense of conducting the business and that the amount included in the premium as loading should be used only to the extent that the other sources of profit are inadequate to meet the expenses and cover unforeseen contingencies.

If we consider that the primary purpose of the loading element of the premium is to defray the expenses of the business and that it is also the primary source of supply for this purpose, I can see little justification for distributing mortality savings in proportion to loadings. It has been argued by those advocating the distribution of mortality savings in propertion to loadings that since the mortality gains are subject to large fluctuations from year to year, a distribution of mortality surplus as a separate item on the basis of the cost of insurance would lead to varied and undesirable fluctuations in the amount of the dividends and that therefore it is desirable to combine the mortality gains with the loading and miscellaneous gains. This objection it seems to me can readily be overcome by establishing a mortality fluctuation fund into which part of the savings in mortality for especially favorable years would be placed and in years of heavy mortality this fund could be drawn upon, thus enabling the company to maintain its dividend schedule.

In a paper which appears in the *Transactions of the Actuarial Society of America* (XIV, 17) Mr. Henry Moir has pointed out that a distribution of mortality gains as a percentage of the cost of insurance is inequitable because of the unequal margins of profit from mortality savings as between the young ages and the old ages if reserves and net premiums are based upon the American Experience Table of mortality. Mr. Moir suggests that a constant multiplied by the amount at risk would come nearer doing justice than a percentage of the cost of insurance. This suggestion is being followed by some companies. Although it is indisputable that in actual results this method comes nearer doing justice than a uniform percentage of the cost of insurance, yet I am unable to see how the method can be justified on scientific grounds.

It seems to me that the remedy is to grade the percentage of the cost of insurance so as to make the results conform approximately to actual experience or what would be a normal experience for the company. With the individual company's own experience and the American Men Table as a guide it should not be difficult to prepare a graded scale of percentages which when applied to the cost of insurance would do justice and at the same time would be easily justified on scientific grounds.

A considerable number of companies are using a three-factor method whereby the loading less an expense charge, usually taken as a constant plus a percentage of the gross premium, is added to the mortality and excess interest dividends to complete the dividend. In only one instance, however, has the writer learned of a company which makes a deduction where the loading is less than the expense charge provided for in the dividend formula.

Some time ago the writer addressed letters to a considerable number of companies writing participating insurance, asking information in regard to their methods of surplus distribution. The answers are so varied that it is impracticable to attempt an analysis. I believe, however, that these letters are of sufficient interest in illustrating the diversity of the methods in use to make it worth while to include extracts from some of them without disclosing the identity of the companies. As a matter of reference I have numbered the replies.

1. Replying to your favor of the 31st ultimo, in re methods of surplus distribution, I beg to say that this company has in a general way followed the contribution formula. Prior to the influenza and war experience the mortality savings were graded on the assumption that the experience was more favorable at the younger ages. The loading factor was graded according to duration of the policies, the amount allowed from this source being rather small. The interest factor was uniform for all policies, ages, and durations. Since the influenza and war experiences we have graded the mortality savings according to policy duration, but uniform as to age of issue, and for a year or two we eliminated the loading factor. It is probable that we shall resume the use of a loading factor, perhaps next year, graded according to the duration of the policies.

2. Regarding this particular company's dividend formula I would say that it is a very arbitrary one based on a first-year dividend, the formula for which I have not been able to produce but which apparently is made up partly from loading and partly from mortality. For subsequent years $1\frac{1}{2}$ per cent of the initial reserve is added. A unique feature was adopted following the influenza losses apparently for the purpose of depressing the natural increase which would result in the dividend from year to year by the use of this formula. The means used was to apply to the whole dividend arrived at in the manner indicated above a percentage equal to 100 minus m where m represents the number of years the policy has been in force.

3. The following is an explanation of our method of surplus distribution which I hope will serve your purpose. This being sent in response to your letter of January 31. With the exception of a few old contracts, our dividends are on the annual basis so that the following refers to annual dividends. We use a contribution method with three factors, namely, mortality, interest, and loading.

(1) Mortality Factor—from Q_x for the valuation mortality table is deducted Q_x as actually experienced by the company, and the balance is multiplied into unity minus the terminal reserve.

(2) Interest Factor—from the net effective rate of interest is deducted the valuation rate of interest and the balance is multiplied into the mean reserve.

(3) Loading Factor—from the gross premium is deducted the net premium and an expense charge, and the balance is accumulated with interest for a year at the net effective rate of interest.

a) The valuation table is Amer. Exp. $3\frac{1}{2}$: Preliminary Term: using the Ohio standard or the Illinois standard, whichever reserve is the greater. (*b*) The values of Q_x as actually experienced by the company were taken for the scale of 1922 as equal to Q_x by the A.M. ultimate table of mortality. (*c*) The net effective rate of interest was taken for the scale of 1922 as 5 per cent. (*d*) The net premium used in (3) above, is the "renewal" net premium for the dividends of all policy years including the first. (*e*) The expense charge used in (3) above consists of a percentage of the gross premium plus a constant. —percentage used for scale of 1922 is $4.50 per $1,000 of insurance. The constant is determined thus; from the insurance expenses of the year are deducted the following: 10 per cent of gross premiums received; the extra loading for first-year policies arising from difference between 1st year net and renewal net under preliminary term valuation method; estimated saving in mortality commuted to present time current year's issue, arising from difference between A.M. select table and A.M. ultimate table.

The residue is divided by the average amount of insurance in force. The ratio was not exactly $4.50 per thousand but ratio was taken as satisfactory. Formula:

$$
{}_n\Delta_x = (q_{x+n-1} - q'_{x+n-1})(1 - {}_nV_x) + (i' - i)M_n V_x(1+i') \\
\hfill (\pi_x - P_{x+1} - .1\,\pi_x - .0045)
$$

The formula assumes: (*a*) Actual mortality experience equals A.M. Select. (*b*) Net effective rate of interest, equals 5 per cent. (*c*) Expenses equal 10 per cent of gross premium plus $4.50 per $1,000 of insurance.

4. The dividends paid by this company contain the usual three factors, mortality savings, excess interest, and gain from loading. Mortality savings is assumed to be 35 per cent to attained age 45, then ½ per cent less for each year to attained age 50, then 1 per cent less to attained age 60 at which age it is 22½ per cent; this percentage applies to all ages above 60. Certain exceptions are made to the above in the computations of dividends for other than the regular policies, such as joint life and five-and ten-year terms. I do not assume you would be interested in the details concerning the dividends on these forms of contracts.

Excess interest is 1¼ per cent of the mean reserve. Though we are on the Illinois basis of valuation in all cases where the values are higher than the Ohio standard, the dividends are on the Ohio basis throughout as the schedule was prepared prior to our using the Illinois standard of valuation.

To determine the gain from loading factor, we deduct 6 per cent of the gross premium plus a constant from the gross premium; the excess of this amount over the net amount is the contribution from loading. The constants are as follows:

Ordinary life	$2.25
Twenty-payment	2.00
Fifteen-payment	2.75
Ten-payment	3.00
Twenty-year endowment	1.05
Fifteen-year endowment	4.00
Ten-year endowment	4.25
Endowment at age 65	varies

Our other forms of policies have varying constants also but I do not assume you would be interested in the exact amounts and I give the above merely for illustration. I might add that the above constants are selected with the idea that when taken with the 6 per cent of the gross premium will cause to be returned to the policy-holder approximately the same amount as when $2.00 plus 10 per cent of the premium is deducted, computed on the net level basis instead of on the preliminary term basis. I, of course, have the contributions from loading tabulated by the various ages but I assume this would burden you with unnecessary detail.

5. Our dividend formula at the present time on the American $3\frac{1}{2}$ per cent full level premium policy is as follows:

On premium paying policies we use a three-factor method: (1) *Interest:* A percentage of the initial reserve. (2) *Mortality:* A constant percentage to attained age 37 then decreasing one-quarter of 1 per cent to age 62 and constant thereafter. (3) *Loading:* A percentage according to duration of the policy, increasing 1 per cent for the first five years, then one-half of 1 per cent for ten years and constant after the fifteenth year. On paid-out policies the interest and mortality return are the two factors used.

6. The following is the rule for the computation of annual dividends payable in 1922:

From the ordinary premium due in 1921, taken on the annual basis, deduct an expense charge beginning at 18 per cent of the mean between the gross annual premium and the net ordinary life annual premium at the same age for the first policy year. The expense charge decreases by 3 per cent of the initial amount each year for fifteen years, then by 2 per cent each year for the next ten years and then by 1 per cent each year for the next ten years to 25 per cent for the thirty-sixth year remaining uniform thereafter at 25 per cent of the initial amount but ceasing in any case when the policy becomes paid-up. The expense charge is, however, in no case to exceed the loading included in the office premium. Add the balance of the premium to the terminal reserve in 1921 and to the sum add interest at 4.3 per cent for one year. From the total deduct the cost of insurance according to the American Experience table and the terminal reserve at the anniversary in 1922.

To the above is to be added a mortality factor equal to 20 per cent of the cost of insurance where the attained age at date of dividend is 35 or less. The percentage for ages above 35 shall decrease by one-half of 1 per cent each year for five years to $17\frac{1}{2}$ per cent at age 40, then by 1 per cent each year for fifteen years to $2\frac{1}{2}$ per cent at age 55, then by 1 per cent each year for five years to nothing at age 60. No addition will be made at ages 60 to 80 inclusive but thereafter the mortality factor shall be 1 per cent of the cost of insurance multiplied by the number of years by which the attained age exceeds 80. The sum is the cash dividend.

7. Our present dividend formula is based upon 30 per cent savings in mortality and 1.4 per cent excess interest earnings. In other words, our annual dividends are computed on the basis of 30 per cent of the cost of mortality plus 1.4 per cent of the initial reserve for the respective form of policy and year for which dividends are being computed. Most of our participating business is on the American $3\frac{1}{2}$ per cent reserve basis and so we make no distinction whatsoever as to the reserve basis when figuring our dividends. In other words, all of our dividends are calculated on the basis of the American Experience Mortality Table with $3\frac{1}{2}$ per cent interest.

8. The dividend distribution formula in use by this company calls for an interest return amounting to 1.3 per cent upon the initial reserve plus a combined loading and mortality return of 52.5 per cent of the loading element. This is applied to all business in force in the company, except that in the case of issues on a 3.5 per cent basis the interest return was reduced to eight-tenths of 1 per cent.

The combination of mortality and loading return is based on the theory that the true loading dividend should increase with the age of the insured, while the mortality factor should correspondingly decrease, a change in one element being assumed to offset a change in the other.

9. This company uses what is commonly known as the three-factor method, the amount available for distribution being derived from the following sources: (1) Surplus interest on the reserve values of the policy; (2) lower mortality than that provided for by the tables used; (3) lower expenses than the amount charged in premiums; and other sources.

The apportionment to individual policies for the year 1922 was made as follows: (1) Surplus interest on the initial reserve calculated on the same mortality table as that used in computing the premiums, the rate of surplus interest being the excess of 4.6 per cent over the rate of interest assumed in calculating the premium. (2) $1.20 per thousand dollars of "sum at risk" at the beginning of the year. (3) 25 per cent of the expense portion of the premium technically called "Loading." The allowance on term policies, etc., was suitably modified.

All dividends in this company are and always have been declared annually on all policies entitled to participate in the surplus of the company whether such participation be in cash, or in the reduction of premium, or applied to purchase reversionary additions or left to accumulate at interest, or surrendered to the company to shorten the endowment or premium-paying period, or applied to secure a deferred dividend endowment. Where the insured has elected to take his share of the surplus in the form of dividend endowment, the annual apportionment is accumulated with benefit of interest and survivorship to the end of the period selected by the insured in his application. Such accumulations are contingently credited to each policy and are payable only in the event of the insured surviving the period and the policy remaining in force under its original terms and conditions. The present value of all dividends thus contingently credited is carried as a liability and is included in the certificate of valuation made by the insurance department.

The use of the constant percentage of the sum at risk as a method of determining the mortality factor is justifiable for at least two reasons, namely:

(1) Facility of application both as regards the apportionment to individual policies and also as a means of determining in advance the amount that would be apportioned by the use of any selected factor.

(2) It gives about the same results as the varying percentages of the cost of insurance, which should be used for purposes of distribution in accordance with recent experience such as the American Men Table of Mortality.

You will observe that in using this method we are able to determine in advance and with very little work the approximate amount of dividends, which we would distribute by the adoption of any particular factors which we might choose.

10. Our dividends are calculated on the three-factor contribution plan. Interest contribution is on the basis of $4\frac{3}{4}$ per cent of the reserve. Mortality savings 40 per cent decreasing as of age at issue to $17\frac{1}{2}$ per cent of the expected cost at age 60. A refund or loading has been made varying from zero to 50 per cent according to the plan, age at issue, and duration of policy.

11. At the present time, our dividend schedules are obtained by taking 65 per cent of the loading and adding interest on the mean reserves on a basis of 5 per cent earnings. If policies are on the $3\frac{1}{2}$ per cent table,

we add $1\frac{1}{2}$ per cent interest, if policies are on the 4 per cent table, we add 1 per cent interest.

We are also at the present time deducting a constant of 50 cents. We make an annual apportionment to deferred dividend poilicyholders on a basis that conforms as equitably as possible to the dividends paid annual dividend policyholders. The deferred dividend policies in various years have been issued with premiums carrying different loadings and in order to get the loading distribution on these policies, we apply the fixed expense charge obtained from the annual dividend policies. Our deferred dividend funds are brought forward with interest at $5\frac{1}{2}$ per cent and from time to time an extra dividend is added on account of lapses.

12. On policies upon which premiums payable during the current policy year shall have been paid to their respective anniversaries in 1922, the distribution from loading shall be the difference between the gross annual premium, and a standard premium which shall be the net premium loaded 16 per cent, plus 10 per cent of the net ordinary life premium. $2.00 per $1,000 of the amount at risk. 1 per cent of the initial reserve.

13. We use the three factor method of calculating dividends as follows: (1) *Interest:* $1\frac{1}{2}$ per cent of the mean reserve. (2) *Mortality:* $2.80 per thousand net amount at risk for the second policy year, decreasing 5 cents per thousand each year to a minimum of $2.00 per thousand net amount at risk. (3) *Loading:* The loading included in the premium less an expense charge of 10 per cent of the gross premium plus $2.00 per thousand.

14. We are using the three-factor method for calculation of dividends, the dividends consisting of gain from loading, mortality savings, and excess interest. The expenses set against the load consist of a percentage of the gross annual premium plus a constant, and the net amount thus derived increased by $4\frac{1}{2}$ per cent which is our present dividend interest basis. The mortality savings is taken as a percentage of the tabular cost of insurance, the percentage being graded according to the attained age of the insured so as to follow more closely the actual mortality profits as derived under the company's experience, the percentage used being 25 per cent up to and including age 30 and gradually decreasing to 10 per cent at attained ages over 75. The interest factor is taken as a percentage of the mean policy reserve. Practically all our policies are valued on the American $3\frac{1}{2}$ per cent, or American 4 per cent basis.

15. Participating policies issued prior to January 1, 1900, are valued on the American Experience $3\frac{1}{2}$ per cent basis and participating policies issued since that date are valued according to the 3 per cent basis. The dividends payable in 1922 by this company have been computed upon the following assumptions:

Actual rate of interest earned on invested reserves, 4.8 per cent net on premium-paying policies and 4.7 per cent on paid-up policies. Expense charged against premium-paying policies not more than twenty years old, 11 per cent of the contract premium, reduced by one-tenth per cent for each year after the twentieth year. The difference between the loading and the expense charge thus obtained to be improved by one year's interest at the rate of 4.8 per cent. In case of convertible five-year term policies, no surplus arises from premium margins or loadings. Actual death losses, 75 per cent of expected by the American Experience Mortality for the first policy year for policies issued at age 21, increasing one-quarter per cent for each age up to 84½ per cent at age 59, and for ages 60 and over, 85 per cent, for the second and subsequent years the rate to increase 1 per cent each year, but not to exceed 85½ per cent the second year, 86 per cent the third year, 86½ per cent the fourth year, 87 per cent the fifth year, 87½ per cent the sixth year, 88 per cent the seventh year, 88½ per cent the eighth year, 89 per cent the ninth year, 89½ per cent the tenth year, and 90 per cent the eleventh year and all subsequent years.

Our dividends are calculated according to the three-factor system. The interest and mortality factors are combined in the actual calculation so that the work is rendered less difficult.

16. This company prepared mortality tables covering its own experience. It was observed that the mortality varied somewhat by kinds, and consequently tables were prepared on life policies, on limited-payment life policies and on endowment policies. Where the business covered different branches, tables were prepared for each branch. In some branches the limited-payment life and endowment mortality did not vary greatly; in others it did. No matter what class or branch, we were always in a position to prepare a premium rate to provide the benefits according to the mortality actually experienced by the company. This premium was loaded sufficiently to meet the actual expenses and contingency reserve. Any excess over this specially constructed premium was added to the interest factor for the total dividend. The interest factor was based upon 4, 4¼, or 4½ per cent, and with a basis rate of 3½ per cent made the interest profit either one-half, three-quarters, or 1 per cent, according to the amount of surplus earned.

17. The formula in use for annual dividend policies at the present time is as follows:

Annual dividends due after March 31, 1921, on Life Policies, issues of 1908 to 1919 (inclusive) and on endowment policies, issues of 1908 to 1914 (inclusive) are composed of (*a*) 10 per cent of the tabular cost of insurance decreasing at the rate of ½ per cent for each year of age after 51, (*b*) 4½ per cent minus valuation rate on initial reserve, and (*c*) 43 cents per thousand, plus 12 per cent of the gross premium on ordinary life policies, and for other plans, 6½ per cent of gross premium for plan being considered. On endowment policies issued in 1915, 1916, 1917, 1918, and 1919 annual dividends are composed of (*a*) and (*b*) as above described and (*c*) 18 cents per thousand plus 13 per cent of the gross premium on a limited-payment life policy having a premium-payment period corresponding to the endowment period. On previous issues and on all term policies annual dividends are composed of (*a*) 15 per cent on the tabular cost of insurance, (*b*) 6 per cent minus valuation rate on initial reserve, and (*c*) 1 per cent on ordinary life gross premiums and 1 per cent on gross premiums for plan being considered, and for term policies, 2 per cent on gross premiums.

18. Replying to your letter of January 31, 1922, I take pleasure in explaining that in the computation of our annual dividends we use a two-factor method, one factor in each annual dividend being a percentage of the loading in the gross premium, and the other factor being excess interest upon the initial reserve on the policy. Obviously, in case of participating paid-up policies, the second factor only is effective.

19. Our company distributes its surplus strictly in accordance with the contribution formula, using an interest rate which is the difference between the basic rate of the contract and 4½ per cent. An American 3 per cent policy would receive 1½ per cent interest on the initial reserve and 25 per cent of the cost of insurance as a vitality gain. The third factor returns 5½ per cent of a life premium based on the age at issue. Paid-up policies of course have two factors only and we return 20 per cent as a vitality gain. Extended term insurance policies have gain from vitality of 10 per cent. Paid-up additions, the interest factor only.

20. We use a three-factor method, distributing mortality savings as a constant on the net amount at risk, interest as a percentage of the mean reserve and all other earnings as a percentage of the loading. The scale now in effect for policies paying a full participating rate is as follows: $2.00 per thousand on the net amount at risk, 1½ per cent of the mean reserve on business valued on 3½ per cent basis, and 25 per cent of the loading. On term policies the loading factor is reduced by 5 per cent. On paid-up policies the first two factors only are used, and on policies paying less than full participating rates, the loading used is the gross premium minus 1.05 times the net premium. If this difference shows a deficiency, it is deducted from the sum of the other two factors. Almost all of our business is on the American 3½ per cent basis, but we have some two and a half million deferred business issued prior to 1905 that is on the combined experience 4 per cent basis, the dividend formula for which is the same, except that on combined 4 per cent business 1 per cent excess interest is distributed instead of 1½ per cent.

21. Our dividends are calculated in a very simple manner, using a three-factor method, as follows: Gain from interest; $1\frac{1}{2}$ per cent of the initial reserve. Gain from mortality; 15 per cent of the cost of insurance. Gain from loading; from the true loading deduct an expense charge consisting of 10 per cent gross premium, plus 10 per cent gross premium for a whole life policy, plus $1.00 per thousand. Our annual dividends for all ages, durations, and plans, except term policies, consist of the sum of the foregoing three factors. We do not pay dividends on double indemnity or disability benefits and where a policy contains these benefits, we deduct the premium charged for such benefits from the gross premium before determining the gain from loading. For policies in the total abstainers class, we use 20 per cent of the cost of insurance instead of 15 per cent.

For term policies we use a two-factor method as follows: Gain from interest; $1\frac{1}{2}$ per cent of the mean reserve. Gain from mortality; $1\frac{1}{2}$ per cent of the cost of insurance for ages at issue 20 to 45 graded to $12\frac{1}{2}$ per cent cost of insurance for ages at issue 55 and over. In the total abstainers section an additional $2\frac{1}{2}$ per cent of the cost of insurance is added as an extra gain from mortality.

The initial reserve used in calculating the gain from interest is the American $3\frac{1}{2}$ per cent Illinois standard terminal reserve, plus the net premium for the current policy year on the same standard. The loading used in order to obtain the gain from loading is the difference between the gross premium and the true net premium on the American Experience table with $3\frac{1}{2}$ per cent interest (this is not the preliminary term net premium).

22. Practically all of our policies issued prior to January 1, 1901, are on the 4 per cent reserve basis, and practically all our participating policies issued since that date are on the 3 per cent reserve basis. For all except our term policies we have one general formula, which has been in use since our reduction of dividends in July, 1920.

Let G.P. = Gross premium
Let L. = Loading
Let I. = Initial reserve
Let K. = Cost of insurance
Let i = Interest on which reserve is based

$(\text{L.} - 11\frac{1}{2}\text{ per cent G.P.})(1.046) + (4.6\text{ per cent} - i)\text{I.} + {}^{*}18\text{ per cent K.} - 75$ cents.

---

* Decreased 1 per cent per age after attained age 35 to a minimum of 3 per cent at age 50 and thereafter.

Since *i* is the rate of interest on which the reserve is based this formula gives us .6 per cent of the initial reserve on the 4 per cent policies, and 1.6 per cent on the 3 per cent policies.

23. All of our policies since organization up to January 1, 1906, were on the Actuaries Table of Mortality and 4 per cent interest. On these policies we pay 1 per cent of the initial reserve as interest return. The percentage of return to the policyholders as a savings from mortality is 55 per cent of the expected, age 20, for the first dividend. The percentage decreased 1 per cent for each quinquennial age and for each dividend after the first. For example, a policy issued at age 20 and receiving its twentieth dividend would receive 36 per cent of the terminal cost for the twentieth year and 1 per cent of the initial reserve.

On all policies subsequent to January 1, 1906, we pay 2 per cent of the initial reserve as interest return; the return as a savings from mortality is the same as set forth above. These policies are on the American Experience Table of Mortality and 3 per cent interest.

24. The first annual dividend which is subject to the payment of the second year's premium is 41 per cent of the loading. The second and subsequent dividends are 41 per cent of the loading accumulated at $4\frac{1}{2}$ per cent interest for one year plus 1 per cent of the mean reserve.

25. Replying to your letter of February 1 concerning the method of surplus distribution in use by this company, we wish to say that our 1922 annual dividends under policies written on a $3\frac{1}{2}$ per cent basis are equal to 0.66 per cent of the mean reserve plus 16.4 per cent of the mortuary cost plus 8.5 per cent of the net premium. Under 4 per cent issues the annual dividends equal 0.33 per cent of the mean reserve plus 16.4 per cent of the mortuary cost plus 8.5 per cent of the net premium.

26. In arriving at the dividends payable under the annual dividend policies, our procedure is to take 1 per cent of the initial reserve, 25 per cent loading and 15 per cent of the cost of insurance. When an annual dividend policy becomes paid-up, or when a deferred dividend policy goes on an annual dividend basis, the dividend is arrived at by taking 1 per cent of the initial reserve and 15 per cent of the cost of mortality.

27. In reply I may state that this company uses the contribution method. The dividend is calculated on the basis of the American 3 per cent Table. On premium-paying policies, the interest assumption is $4\frac{1}{2}$ per cent, which gives, of course, a margin of $1\frac{1}{2}$ per cent excess interest. Mortality savings are graded according to age and duration: 30 per cent of the cost is allowed for ages 45 and under, and this decreases 1 per cent for each age over 45 and also 1 per cent for each year of duration until a minimum of 10 per cent is reached. The percentage of gross premium taken out for expenses is represented by $8\frac{1}{2}$ per cent of the premium itself plus 6 per cent of the ordinary life premium, and the difference between

the loading and the expense charge thus obtained is improved by one year's interest at the rate of $4\frac{1}{2}$ per cent above mentioned.

28. For a great many years we used the three-factor method according to the following outline:

(1) *Loading:* Each premium is charged for expenses 50 cents plus 10 per cent of the ordinary life rate at the same age plus 5 per cent of the rate for the form in question. This charge deducted from the loading gives the dividend for this source. (2) *Interest:* $1\frac{1}{2}$ per cent on the initial reserve. (3) *Mortality:* 20 per cent of the tabular cost of insurance.

Under this system of distribution, which was, of course, sometimes slightly varied as to the constants, we paid a first annual dividend at the end of the second policy year. When we began paying the dividend at the end of the first policy year we adopted the following formula, still using level net premium reserves and net premiums:

(1) *Loading:* From the loading deduct 7 per cent from the ordinary life gross rate and 8 per cent of the rate in question plus $1.00 per thousand. For endowments deduct $7\frac{1}{2}$ per cent of the plan in question instead of 8 per cent. (2) *Interest:* $1\frac{1}{2}$ per cent of the initial reserve. (3) *Mortality:* 20 per cent of the tabular cost of insurance.

For 1922 dividends we are discarding the three-factor method for a two-factor method, and basing all calculations on the Illinois Standard net renewal premiums and reserves.

(1) *Loading:* The full loading less 9 per cent of the gross premium and a constant varying slightly according to plan. (2) *Interest:* $1\frac{1}{2}$ per cent of the mean reserve.

29. This company has always followed the two-factor method and pays no dividends from loading. The dividends accrue therefore from:

First: mortality savings which are based upon percentages of tabular cost, and these percentages are gradual in accordance with the company's experience of mortality which has shown gradual decrease of mortality savings after policies become older.

Second: from excess interest earnings on terminal reserves. We use a uniform net rate earned of $5\frac{1}{8}$ per cent, and on 3 per cent policies this formula gives $2\frac{1}{8}$ excess interest earnings, and on 4 per cent policies $1\frac{1}{8}$ per cent.

30. As regards our method of distribution we may say that for a great many years we have used a three-factor formula and our formula at the present time as regards interest return is on the assumption of 4.6 per cent net rate of interest earned so that on 4 per cent policies our distribution is six-tenths of 1 per cent, on $3\frac{1}{2}$ per cent policies 1.1 per cent, and on 3 per cent policies 1.6 per cent all on the initial reserve. On account of the mortality distribution our old formula used to distribute 20 per cent of the cost of insurance. Under our new formula we have not

altogether got away from a distribution based on the cost of insurance but we have to some extent. Our present formula on all business either 4 per cent, $3\frac{1}{2}$ per cent, or 3 per cent distributes 6 per cent of the cost of insurance plus $2.00 per thousand of the amount at risk on premium paying life and endowment policies. On paid-up policies and term policies the distribution allows $1.00 on the amount at risk. In this connection we mean by the amount at risk the amount of insurance less the terminal reserve.

On account of expense saving our distribution returns in relation to life and endowment policies the total loading received less an expense charge of 9 per cent of the net premium on the plan of insurance plus 6 per cent of the net premium for ordinary life at issue. In relation to term policies the loading return is full loading less expense charge of 6 per cent of the net premium for the plan of insurance plus 9 per cent of the net plan for ordinary life at the same age. This expense charge consisting of two percentages is used in relation to all classes of business, 4 per cent, $3\frac{1}{2}$ per cent, and 3 per cent.

A practice in use by several companies but not mentioned in any of the extracts quoted above is that of paying an extra dividend at five-year intervals. The idea back of this practice is that of rewarding the surviving persistent policyholders, thus introducing some of the element of the deferred dividend system. It seems to the writer that the theory of thus rewarding the surviving persistent policyholders has much to justify it.

A snap judgment after reading the foregoing extracts is likely to lead one to the conclusion that because of lack of uniformity the whole matter of surplus distribution is one which is arbitrarily disposed of in each company without relation to the equities of the policyholders. Yet such conclusions are not justified because the methods of the companies and the conditions under which companies operate are perhaps just as varied as are the dividend methods.

Would it therefore not be more logical to conclude that each company has solved its own problem independently in an attempt to do justice to its policyholders?

BIBLIOGRAPHY

HANN, "Surplus Distribution Methods Used in Great Britain," *T.A.S.A.*, III, 431.

RYAN, "Methods Used in Great Britain." *J.I.A.*, XXXIII, 75.

CARMENT, "Plan Used by Australian Companies," *T.A.S.A.*, III, 352.

HOMANS, "On the Equitable Distribution of Surplus," *J.I.A.*, XI, 121.

PAPPS, "Note on the Original Contribution Plan," *T.A.S.A.*, IX, 49.

ROTHERY, "Distribution in Relation to Premiums and Valuation Methods," *J.I.A.*, XXX, 131.

LIDSTONE, "Dr. Sprague's Plan of Distribution," *J.I.A.*, XXXII, 73.

BROWNE, "Mr. Browne's Method of Distribution," *J.I.A.*, XXXII, 194.

MOIR, "Mortality Surplus and Its Distribution," *T.A.S.A.*, XIV, 17.

FACKLER, "Early Dividend System of American Life Insurance Companies," *T.A.S.A.*, I, 3.

APPLICATION OF THE AMERICAN MEN MORTALITY TABLE TO FINANCIAL STATEMENTS FOR COMPANIES' OWN INFORMATION

By E. L. MARSHALL

The fact that the American Men Mortality Table apparently will not be adopted as a legal reserve requirement in the very near future, has had a tendency to a neglect of some of the practical advantages of the table. We are so crowded with supplying all the details that are required, that we are rather prone to think that we have little time for additional details that are not required. The value to a young company of an annual statement prepared on the basis of the new mortality table instead of the American Experience should nevertheless be well worth the additional work involved.

It is not my purpose to outline here the various ways in which the table may be advantageously used. These have already been set forth very clearly in Mr. Graham's address at our last meeting. Mr. Morris in his paper on financial statements also suggested the value of the use of the table. It is believed, however, that an actual illustration of the working out of the application of the new table to our annual statements will be of valuable interest and show the advantages of such a statement much more vividly than could be done otherwise.

For this purpose it was necessary to assume a typical company. Several assumptions were tried, but the one which was finally considered of most value to members of the Institute was that of a non-participating company ten years of age with thirty millions of business in force, and operating under the Illinois valuation requirements.

Representative middle-western non-participating companies were selected as guides in the various assumptions as to actual mortality, first-year and renewal expenses, lapse ratio, interest earnings, and rate of increase in insurance in force. The gross premiums were taken as averages of those charged by these companies, and at decennial ages are as follows.

Age	O. L.	20 P. L.	20 E.
20	15.30	22.96	42.14
30	19.59	27.57	43.05
40	27.17	34.98	45.66
50	40.97	47.40	52.88

Fifty per cent of the insurance in force was assumed to be on the ordinary life plan, 45 per cent on the twenty-payment life plan and 5 per cent on the twenty-year Endowment plan. The assumed distribution as to ages was such that the effective age fell between age 33 and age 34. First-year expenses were taken as 90 per cent of first-year gross premiums, and renewal insurance expenses one-sixth of renewal premiums. Interest received was assumed to be at the rate of 6 per cent, and investment expenses one-fourth of 1 per cent of the mean ledger assets.

All income and disbursement items not essential to the comparison were omitted for the sake of clearness. The only items of income assumed are, therefore, premiums and interest, and the disbursements are death claims, surrender values (cash and applied), insurance expenses, and investment expense.

The automatic premium loan provision was assumed to be in use by the company, and therefore the amount of extended insurance and paid-up insurance negligible. The result of this assumption is that the amount shown as granted under the non-forfeiture provisions is considered the same under the different plans of valuation. If the extended insurance or the paid-up insurance option were the automatic one, the initial reserve would be less by the American Men tables, and the increase over the American Experience basis in the gain from lapses, surrenders, etc., would therefore be still greater than is shown in the comparison. The new gain and loss exhibit suggested by the Insurance Commissioners omits deferred and uncollected premiums, and it was considered unnecessary to introduce them into this exhibit. All other non-ledger assets, such as accrued interest, etc., were also omitted, as these items add nothing to the comparison, and the fewer the items the easier it is to follow the comparison.

In applying the American Men Table to the statement, the question arises as to whether the select or the ultimate tables should be used. The amount of labor involved in the calculations is, of course, materially less with the ultimate tables. It has been pointed out that as the experience of some of the large companies contributing to the mortality investigation is lower than the tables, there must be some that are higher, and if a company happens to be in the latter class, the use of the ultimate table will help to reduce the showing of loss from mortality. On the other hand, the whole object of this statement is to show the company officials the actual experience of the company. If the mortality is higher than the average of the companies contributing to the mortality investigation, that is the thing the company officials want to know. It is to be expected that the actual mortality of the average company in the investigation would be higher than the table one year, and lower another year. But if the actual mortality continues higher, this information would be a foundation for revision of medical selection; unless it were the increased mortality to be expected from the particular locality, in which case the officers would receive from the statement prepared on the select basis information helpful in determining the adjustments necessary to be made in gross premiums, medical selection, etc., on account of this factor. The greater value from the statement would, therefore, be obtainable by the use of the American Men Select Table.

As the reserves calculated by the use of the American Men Mortality tables are larger than those by the American Experience, except at the earliest policy years, the resulting increase in aggregate reserve liability is given as one objection to the use of the new mortality in statements of young companies. While that is not necessarily a valid objection, there is a complication in the case of very young companies, since where the first-year insurance is a large proportion of the total insurance, the new table gives insufficient reserves for the legal requirements. This requires that the increase in the additional reserve required by law be entered in the Gain and Loss Exhibit as a special loss item.

A method which avoids these objections is to compute a net premium just sufficient to provide for mortality according to the American Men Select Table, and to provide a reserve equal to that required by law. This obviates the necessity of changing the liabilities and surplus as otherwise reported to the Department. It also has the advantage of showing the actual facts as they exist under the present legal requirements, by dividing the premium into the part required for the mortality that is really expected, the part that is actually required for legal reserve, and the part that is actually released for expense. Where the regular American Men Select or Ultimate reserves are used, the premiums during the first year are divided into one portion for the mortality, one portion for expenses and one portion to provide for a *part* of the required reserve, the balance of the reserve to be taken bodily out of surplus. While the effect on surplus is the same in either case, the purpose of making up the special statement is the clearer conception of the sources of increase or decrease in surplus, and it would appear preferable to provide the entire reserve out of the premium and show the additional expenses as the cause of loss in surplus.

In other words, during the first policy year, the regular American Men reserves show a larger amount released for expenses than is actually the case. In later years it divides the premium into one part for mortality, one part for current expenses, one part for legal reserve, and one part for an additional reserve to provide for expenses in the future. As a matter of fact, however, the amount of expenses chargeable to each policy will normally decrease as the policy and the company grow older. Also the excess of first-year expenses over first-year margins is preferably charged against the renewal premiums in amounts diminishing with the duration of the policy. For these reasons the decreasing loading resulting from the increasing net premiums required to provide mortality in accordance with the American Men Table, and reserves equal to the American Experience would not seem to be greatly out of harmony with the actual facts.

For the purpose of comparison, the following shows the Annual Statement and Gain and Loss Exhibit on all four bases, the American Experience, the American Men Ultimate, the American Men Select, and the Combination of the American Men Select mortality with American Experience mean reserves, the symbol AM^{ae} being used to designate the last-mentioned basis. The tables which have been designated as "Select" follow the ultimate mortality rates after the first five years, as there are available no other American Men Select rates. For the purpose of this paper the use of the simpler term "Select" seemed preferable to that of "Select and Ultimate." Net premiums and reserves have been calculated by the Illinois Standard method of modification and $3\frac{1}{2}$ per cent interest. Valuation on a 4 per cent or $4\frac{1}{2}$ per cent

Income

Ledger assets of previous year		$1,417,600.11
First-year premiums	$212,585.01	
Renewal premiums	585,218.22	
Total premiums	$797,803.23	
Interest	95,273.18	
Total income		893,076.41
Forward		$2,310,676.52

Disbursements

Forward		$2,310,676.52
Death claims	$124,000.00	
Surrender values (cash, notes, etc.)	40,278.71	
Insurance expenses	288,862.88	
Investment expenses	4,088.81	
Total disbursements		$ 457,230.40
Balance (ledger assets current year)		$1,853,446.12

Liabilities, Previous Year

	Am. Ex.	AM^{ae}	AM(5)	AM Select
Reserve required by law	$1,217,600.11	$1,217,600.11	$1,217,600.11	$1,217,600.11
Additional reserve	....	....	33,457.39	45,282.98
Capital	100,000.00	100,000.00	100,000.00	100,000.00
Surplus	100,000.00	100,000.00	66,542.61	54,717.02
Assets previous year	$1,417,600.11	$1,417,600.11	$1,417,600.11	$1,417,600.11

Liabilities, Current Year

	Am. Ex.	AM^{ae}	AM(5)	AM Select
Reserve required by law	$1,589,062.73	$1,589,062.73	$1,589,062.73	$1,589,062.73
Additional reserve	....	....	49,164.96	64,433.37
Capital	100,000.00	100,000.00	100,000.00	100,000.00
Surplus	164,383.39	164,383.39	115,218.43	99,950.02
Assets current year	$1,853,446.12	$1,853,446.12	$1,853,446.12	$1,853,446.12

GAIN AND LOSS EXHIBIT

	AMERICAN EXPERIENCE			AM^{ae}			AM$^{(5)}$			AM SELECT		
		Gain	Loss		Gain	Loss		Gain	Loss		Gain	Loss
Gross prem......	$797,803.23			$797,803.23			$797,803.23			$797,803.23		
Net prem........	614,026.54			501,043.66			529,234.11			513,969.18		
Loading.........	183,776.69			296,759.57			268,569.12			283,834.05		
Ins. ex..........	288,862.88			288,862.88			288,862.88			288,862.88		
Gain or loss from loading........			$105,086.19		$ 7,896.69				$20,293.76			$ 5,028.83
Interest rec'd....	95,273.18			95,273.18			95,273.18			95,273.18		
Inv. ex..........	4,088.81			4,088.81			4,088.81			4,088.81		
Net int. income.	91,184.37			91,184.37			91,184.37			91,184.37		
Interest req'd....	52,592.25			50,468.79			52,224.28			52,355.89		
Gain from int....		$ 38,592.12			40,715.58			$38,960.09			$38,828.48	
Expected mort...	243,939.62			120,361.88			139,422.48			119,809.49		
Claims incurred.	124,000.00			124,000.00			124,000.00			124,000.00		
Ter. res. released	7,285.04			7,375.14			7,761.40			7,932.05		
Actual mort.....	116,714.96			116,624.86			116,238.60			116,067.95		
Gain from mort.		127,224.66			3,737.02			23,183.88			3,741.54	
Res. released on sur., etc.......	43,931.51			52,312.81			47,104.32			47,970.52		
Paid thereon.....	40,278.71			40,278.71			40,278.71			40,278.71		
Gain from sur., etc..........		3,652.80			12,034.10			6,825.61			7,691.81	
Incr. in surplus...			64,383.39			$64,383.39			48,675.82			45,233.00
Totals........		$169,469.58	$169,469.58		$64,383.39	$64,383.39		$68,969.58	$68,969.58		$50,261.83	$50,261.83
Mort. ratio....	48 per cent			97 per cent			83 per cent			97 per cent		

interest basis would have been of interest, but lack of time prevented the making of the additional calculations, and for some reasons, such as increasing taxation, uncertain net earnings, etc., it may be as well to use the $3\frac{1}{2}$ per cent rate.

An analysis of the above statement indicates the following interesting comparisons in general items:

The American Experience basis shows a very large loss from loading, the American Men Ultimate shows a loss from loading of less than one-fifth of that by the American Experience, the American Men Select shows only a very nominal loss from loading, and the combination basis of American Men Select mortality and required legal reserves shows a small gain from loading.

The gain from interest does not vary greatly by the various plans.

The gain from mortality on the basis of the American Experience is more than five times that of the American Men Ultimate basis, the latter being about six times that of either the Select basis or the combination basis. The last two show almost negligible gains in mortality.

The American Experience basis shows the lowest gain from surrenders, etc., this item being about twice as large on the basis of the American Men tables and still larger on the combination basis. The higher gain on the last basis is due to the large proportion of lapses at the end of the first year when the terminal reserves are higher on the combination basis than on the other bases.

The items of amount of surplus and of increase in surplus are the same by the American Experience and the Combination bases. They are materially smaller on the American Men Select basis and still less on the Ultimate basis. The item of excess of individual policy assets over corresponding policy liabilities is omitted on the assumption that this item is computed on the true reserve basis. If the excess over the mean reserve is used, the amount of excess on the basis of the American Men Select or Ultimate reserves would differ from that of each of the other bases, and this would correspondingly change the amount of the reduction in surplus resulting from the increased reserves.

The effect of the application of the different tables during the first two or three policy years is, as to some items, directly opposite to the effect in later years. The comparison of aggregate results

First-Year Business

Ledger assets at beginning of year.............. $200,000.00

Income

First-year premiums	$212,585.01	
Interest	12,263.61	
Total income		$224,848.62
Forward		$424,848.62

Disbursements

Forward		$424,848.62
Death claims	$ 12,000.00	
Expenses new business	191,326.51	
Investment expenses	526.24	
Total disbursements		$203,852.75
Balance (ledger assets current year)		$220,995.87

Liabilities, Current Year

	Am. Ex.	AM^{ae}	AM(5)	AM Select
Reserve (Co.'s calculation)	$ 39,660.80	$ 39,660.80	$ 24,660.00	$ 18,265.20
Additional reserve	....	....	....	....
Required by law	....	....	15,000.80	21,395.60
Capital	100,000.00	100,000.00	100,000.00	100,000.00
Surplus	81,335.07	81,335.07	81,335.07	81,335.07
Total	$220,995.87	$220,995.87	$220,995.87	$220,995.87

Assets beginning of year	$220,000.00	Surplus beginning of year	$100,000.00
Capital	100,000.00		

FIRST-YEAR BUSINESS. GAIN AND LOSS EXHIBIT

	AMERICAN EXPERIENCE			AM^{ae}			$AM^{(5)}$			AM SELECT		
		Gain	Loss		Gain	Loss		Gain	Loss		Gain	Loss
Gross prem.	$212,585.01			$212,585.01			$212,585.01			$212,585.01		
Net prem.	73,792.78			51,702.49			43,418.43			30,616.45		
Loading	138,792.23			160,882.52			169,166.58			181,968.56		
Ins. ex.	191,326.51			191,326.51			191,326.51			191,326.51		
Loss from loading			$52,534.28			$30,443.99			$22,159.93			$ 9,357.95
Int. rec'd	12,263.61			12,263.61			12,263.61			12,263.61		
Inv. exp.	526.24			526.24			526.24			526.24		
Net int. income	11,737.37			11,737.37			11,737.37			11,737.37		
Int. req'd	1,291.37			904.80			759.81			535.79		
Gain from int.		$10,446.00			$10,832.57			$10,977.56			$11,201.58	
Expected mort.	35,416.30			12,906.35			19,510.88			12,879.69		
Claims incurred	12,000.00			12,000.00			12,000.00			12,000.00		
Ter. res. released	7.05			40.14			7.36			7.35		
Actual mort.	11,992.95			11,959.86			11,992.64			11,992.65		
Gain from mort.		23,423.35			946.49			7,518.24			887.04	
Loss from add'l res. req'd by law									15,000.80			21,395.60
Decrease in surplus		18,664.93			18,664.93			18,664.93			18,664.93	
Total		$52,534.28	$52,534.28		$30,443.99	$30,443.99		$37,160.73	$37,160.73		$30,753.55	$30,753.55

is, therefore, materially affected by the ratio which the amount of first-year insurance bears to the total insurance in force. To give some idea as to how the above comparisons would be affected by a variation in the proportion of new business, the following shows the financial statement and Gain and Loss Exhibit as applied to first-year business only. While it does not represent the case of a company in its first year in all its details because of such items as overhead expense omitted, etc., it nevertheless indicates clearly the effect which the first-year business has on the statement as a whole.

From the above statement it will be noted that during the earliest years of the company, the American Men tables give a lower reserve than is required by law. An additional reserve is necessarily set up to comply with the legal requirements, with the result that, during the first year, the surplus is not affected by the use of the different tables. The chief difference is on the allocation of the loss in surplus from loading. This loss is the largest on the American Experience and is partly offset by the larger gain in mortality. The American Men Select basis and the Ultimate basis show a very much smaller loss from loading, which is compensated partly by lower mortality gain and partly by the amount taken out of surplus as additional reserve required by law. The combination plan avoids this last item by requiring the premium to take care of all required reserve, assigning the loss in surplus entirely to excess of expenses over the loading.

To further facilitate comparison of the various bases of statement, I have appended tables of the net premiums, terminal and mean reserves for ten years at ages 30 and 40. The effective ages for most of the companies represented in the Institute is undoubtedly somewhere between these ages. Those desiring to experiment for the approximate effect on their own statements could obtain close results by using the tables at these ages so weighted as to make the effective age on the American Experience basis the same as that of the particular company to which it is applied.

The calculation of the net premiums and terminal reserves for the American Men Select Mortality, producing American Experience mean reserves, was by the following simple formula.

$$P_x^{(n)\prime} = H - {}_{n-1}V'_x$$

$$ {}_nV'_x = 2\,{}_nMR_x - H$$

Where ${}_nMR_x$ = Mean reserve by American Experience tables

$P_x^{(n)'}$ = Net premium required for nth year on the special basis

${}_nV'_x$ = Terminal reserve for nth year on the special basis

$$H=\frac{2\,{}_nMR_x+1000\,c_{x+n-1}-u_{x+n-1}}{1+u_{x+n-1}}$$

c_x and u_x being by the American Men Select table.

For the convenience of those desiring to calculate further reserves, I am including tables of c_x and u_x columns on the basis of the American Men mortality table with $3\frac{1}{2}$ per cent interest, as these columns are not included in the *Report of the American Men Mortality Investigation.* Wright's formula was used in preference to Fackler's, as the c_x column at the same time gives us the first-year premiums on full preliminary term policies. The c_x column was calculated by multiplying q_x by v and may therefore differ in the last place from the result obtained by dividing C_x by D_x.

The use of any illustration involves assumptions that will differ largely from those actually experienced by many companies and will differ from those which others would have made in making similar calculations. These illustrations, comparisons, and tables are presented only with the thought that they may induce others to make similar comparisons, and help somewhat in promoting a more general use of the American Men Table for company information.

COMPARISON OF NET PREMIUMS

AGE 30

YEAR	ORDINARY LIFE				20-PAYMENT LIFE				20-YEAR ENDOWMENT			
	Am. Ex.	AM^{ae}	$AM^{(5)}$	AM Select	Am. Ex.	AM^{ae}	$AM^{(5)}$	AM Select	Am. Ex.	AM^{ae}	$AM^{(5)}$	AM Select
1.............	8.14	5.48	4.31	2.91	8.14	5.48	4.31	2.91	22.94	20.32	19.93	18.53
2.............	17.68	12.79	15.27	15.20	26.02	21.15	22.86	22.76	40.82	36.05	38.48	38.38
3.............	17.68	13.28	15.27	15.20	26.02	21.69	22.86	22.76	40.82	36.67	38.48	38.38
4.............	17.68	13.35	15.27	15.20	26.02	21.80	22.86	22.76	40.82	36.86	38.48	38.38
5.............	17.68	13.45	15.27	15.20	26.02	21.95	22.86	22.76	40.82	37.07	38.48	38.38
6.............	17.68	13.67	15.27	15.20	26.02	22.18	22.86	22.76	40.82	37.39	38.48	38.38
7.............	17.68	13.83	15.27	15.20	26.02	22.38	22.86	22.76	40.82	37.64	38.48	38.38
8.............	17.68	13.90	15.27	15.20	26.02	22.51	22.86	22.76	40.82	37.85	38.48	38.38
9.............	17.68	13.97	15.27	15.20	26.02	22.63	22.86	22.76	40.82	38.05	38.48	38.38
10.............	17.68	14.06	15.27	15.20	26.02	22.76	22.86	22.76	40.82	38.27	38.48	38.38

COMPARISON OF TERMINAL RESERVES

AGE 30

YEAR	ORDINARY LIFE				20-PAYMENT LIFE				20-YEAR ENDOWMENT			
	Am. Ex.	AM^{ae}	AM(5)	AM Select	Am. Ex.	AM^{ae}	AM(5)	AM Select	Am. Ex.	AM^{ae}	AM(5)	AM Select
1.............	....	2.66	....	....	....	2.66	....	....	15.45	18.08	16.24	16.22
2.............	9.87	12.11	11.37	11.85	18.58	20.79	19.26	19.70	50.15	52.29	52.39	52.79
3.............	20.08	22.25	23.17	23.99	37.88	40.02	39.26	40.00	86.30	88.32	89.94	90.62
4.............	30.62	32.78	35.36	36.50	57.93	60.02	59.99	61.00	123.93	125.88	128.92	129.85
5.............	41.52	43.59	47.95	49.28	78.76	80.75	81.45	82.61	163.13	164.93	169.38	170.43
6.............	52.80	54.74	60.95	62.25	100.40	102.25	103.68	104.78	203.96	205.60	211.36	212.35
7.............	64.44	66.35	74.32	75.60	122.88	124.67	126.65	127.69	246.50	248.04	254.91	255.83
8.............	76.46	78.33	88.05	89.32	146.23	147.96	150.39	151.37	290.83	292.27	300.07	300.93
9.............	88.86	90.70	102.16	103.41	170.48	172.15	174.93	175.84	337.02	338.36	346.92	347.72
10.............	101.65	103.44	116.63	117.86	195.67	197.27	200.26	201.11	385.17	386.39	395.53	396.26

COMPARISON OF MEAN RESERVES

AGE 30

YEAR	ORDINARY LIFE			20-PAYMENT LIFE			20-YEAR ENDOWMENT		
	*Am. Ex.	AM(5)	AM Select	*Am. Ex.	AM(5)	AM Select	*Am. Ex.	AM(5)	AM Select
1	4.07	2.16	1.46	4.07	2.16	1.46	19.20	18.09	17.38
2	13.78	13.32	13.53	22.30	21.06	21.23	53.21	53.06	53.69
3	23.82	24.91	25.52	41.25	40.69	41.23	88.64	90.40	90.89
4	34.19	36.90	37.85	60.92	61.06	61.88	125.53	128.67	129.42
5	44.91	49.29	50.49	81.36	82.15	83.19	163.94	168.39	169.33
6	56.00	62.09	63.37	102.59	104.00	105.08	203.96	209.61	210.58
7	67.46	75.27	76.53	124.65	126.58	127.62	245.64	252.38	253.28
8	79.29	88.82	90.06	147.57	149.95	150.91	289.08	296.73	297.57
9	91.50	102.74	103.97	171.37	174.09	174.99	334.34	342.74	343.51
10	104.10	117.03	118.24	196.09	199.03	199.86	381.51	390.47	391.18

* AM^{ae} Mean Reserves same as American Experience; mortality rate same as AM Select.

COMPARISON OF NET PREMIUMS

AGE 40

YEAR	ORDINARY LIFE				20-PAYMENT LIFE				20-YEAR ENDOWMENT			
	Am. Ex.	AM^{ae}	AM(5)	AM Select	Am. Ex.	AM^{ae}	AM(5)	AM Select	Am. Ex.	AM^{ae}	AM(5)	AM Select
1	9.46	6.47	5.64	3.59	9.46	6.47	5.64	3.59	19.89	16.93	16.36	14.31
2	24.36	19.03	22.70	22.55	32.47	27.17	30.46	30.26	42.90	37.67	41.17	40.98
3	24.36	19.85	22.70	22.55	32.47	28.03	30.46	30.26	42.90	38.59	41.17	40.98
4	24.36	20.14	22.70	22.55	32.47	28.35	30.46	30.26	42.90	38.97	41.17	40.98
5	24.36	20.51	22.70	22.55	32.47	28.74	30.46	30.26	42.90	39.38	41.17	40.98
6	24.36	21.09	22.70	22.55	32.47	29.34	30.46	30.26	42.90	40.00	41.17	40.98
7	24.36	21.54	22.70	22.55	32.47	29.81	30.46	30.26	42.90	40.49	41.17	40.98
8	24.36	21.77	22.70	22.55	32.47	30.08	30.46	30.26	42.90	40.77	41.17	40.98
9	24.26	22.01	22.70	22.55	32.47	30.33	30.46	30.26	42.90	41.05	41.17	40.98
10	24.26	22.24	22.70	22.55	32.47	30.57	30.46	30.26	42.90	41.31	41.17	40.98

COMPARISON OF TERMINAL RESERVES

AGE 40

YEAR	ORDINARY LIFE				20-PAYMENT LIFE				20-YEAR ENDOWMENT			
	Am. Ex.	AM^{ae}	AM(5)	AM Select	Am. Ex.	AM^{ae}	AM(5)	AM Select	Am. Ex.	AM^{ae}	AM(5)	AM Select
1	....	2.99	....	....	....	2.99	....	....	10.90	13.87	11.16	11.14
2	15.36	17.70	17.44	18.24	23.84	26.16	25.53	26.26	46.13	48.40	48.30	49.01
3	31.17	33.35	35.24	36.72	48.54	50.67	51.74	53.10	82.75	84.81	86.63	87.94
4	47.45	49.49	53.39	55.51	74.11	76.10	78.68	80.60	120.81	122.70	126.20	128.05
5	64.19	66.00	71.87	74.40	100.57	102.32	106.33	108.58	160.34	161.98	167.05	169.21
6	81.39	82.85	90.66	93.14	127.97	129.36	134.71	136.85	201.44	202.72	209.23	211.29
7	99.03	100.39	109.74	112.17	156.31	157.57	163.83	165.84	244.15	245.29	252.80	254.75
8	117.11	118.34	129.08	131.46	185.62	186.75	193.68	195.58	288.56	289.56	297.81	299.64
9	135.60	136.72	148.67	151.00	215.91	216.92	224.31	226.08	334.74	335.61	344.35	346.08
10	154.48	155.48	168.47	170.74	247.22	248.11	255.72	257.37	382.78	383.52	392.52	394.12

COMPARISON OF MEAN RESERVES

AGE 40

YEAR	ORDINARY LIFE			20-PAYMENT LIFE			20-YEAR ENDOWMENT		
	*Am. Ex.	AM(5)	AM Select	*Am. Ex.	AM(5)	AM Select	*Am. Ex.	AM(5)	AM Select
1	4.73	2.83	1.80	4.73	2.83	1.80	15.40	13.76	12.73
2	19.86	20.07	20.40	28.16	28.00	28.26	49.97	50.34	50.57
3	35.45	37.69	38.76	52.43	53.87	54.81	85.90	88.05	88.97
4	51.49	55.67	57.39	77.56	80.44	81.98	123.24	127.00	128.49
5	68.00	73.98	76.23	103.58	107.74	109.72	162.03	167.21	169.12
6	84.97	92.62	95.05	130.51	135.75	137.85	202.35	208.73	210.74
7	102.39	111.55	113.93	158.37	164.50	166.48	244.25	251.60	253.51
8	120.25	130.76	133.09	187.20	193.99	195.84	287.81	295.89	297.69
9	138.54	150.23	152.51	217.00	224.23	225.96	333.11	341.67	343.35
10	157.22	169.92	172.15	247.80	255.25	256.86	380.22	389.02	390.59

* AM^{ae} Mean Reserves same as American Experience; mortality rate same as AM Select.

VALUATION COLUMNS

$AM^{(5)}$ 3½ Per Cent

Age	c_x	u_x	Age	c_x	u_x
15	.003343	1.038594	59	.023662	1.060980
16	.003411	1.038669	60	.025778	1.063375
17	.003507	1.038766	61	.028048	1.065940
18	.003585	1.038853	62	.030512	1.068753
19	.003681	1.038962	63	.033208	1.071840
20	.003787	1.039074	64	.036116	1.075195
21	.003884	1.039175	65	.039285	1.078868
22	.003980	1.039278	66	.042686	1.082841
23	.004039	1.039349	67	.046406	1.087219
24	.004106	1.039422	68	.050396	1.091953
25	.004164	1.039484	69	.054725	1.097142
26	.004203	1.039525	70	.059391	1.102789
27	.004242	1.039567	71	.064444	1.108963
28	.004261	1.039587	72	.069884	1.115695
29	.004280	1.039608	73	.075739	1.123038
30	.004309	1.039640	74	.082048	1.131044
31	.004328	1.039661	75	.088831	1.139797
32	.004357	1.039693	76	.096145	1.149378
33	.004435	1.039770	77	.104010	1.159860
34	.004517	1.039871	78	.112377	1.171222
35	.004628	1.039974	79	.121440	1.183785
36	.004773	1.040135	80	.131150	1.197556
37	.004947	1.040321	81	.141469	1.212545
38	.005140	1.040534	82	.152531	1.229022
39	.005372	1.040784	83	.164300	1.247063
40	.005643	1.041085	84	.176957	1.267066
41	.005952	1.041415	85	.190406	1.289033
42	.006319	1.041809	86	.204638	1.313118
43	.006705	1.042237	87	.219604	1.339445
44	.007169	1.042732	88	.235826	1.369195
45	.007671	1.043287	89	.252850	1.401868
46	.008232	1.043892	90	.270870	1.438201
47	.008870	1.044587	91	.289333	1.477428
48	.009556	1.045337	92	.310222	1.524487
49	.010338	1.046200	93	.330319	1.572662
50	.011188	1.047127	94	.351343	1.626429
51	.012116	1.048139	95	.374647	1.690500
52	.013159	1.049294	96	.397208	1.757547
53	.014280	1.050523	97	.428406	1.859492
54	.015536	1.051915	98	.442155	1.908281
55	.016879	1.053402	99	.483092	2.070000
56	.018377	1.055065	100	.543478	2.365714
57	.019990	1.056866	101	.552106	2.415000
58	.021749	1.058835	102	.644126	3.104999

SUBSTANDARD INSURANCE: ITS EVOLUTION AND A REVIEW OF SOME OF ITS PRINCIPLES

By FRANKLIN B. MEAD

A substandard life may be defined as one which is not considered entitled to a regular form of policy at regular rates or, perhaps more properly, since we will undertake to show in the course of this paper that substandard lives may not be properly and adequately treated by modification of plan alone without increase in rate, should be defined as one which is not entitled to insurance at the regular rate of premium granted lives in general.

The term "substandard" does not appear in the index of the first forty volumes of the *Journal of the Institute of Actuaries.* In England the terms "rejected lives," "invalid lives," "impaired lives" and "diseased lives" have been used in place of our American designation "substandard lives."

Inasmuch as a historical review of the development of a subject generally throws a great deal of light on its principles and trend it may add to the understanding of the subject if we devote at the outset a little attention to the historical evolution of the treatment of substandard lives.

I. EVOLUTION

As is well known, the earliest insurance resulted from the fact that men went into foreign parts on religious pilgrimages or trading expeditions and from the very earliest times insurance organizations were organized to grant insurance protection to those in special occupations, such as sea-faring for instance. Therefore, let us begin, for the particular purposes of our present subject, with the treatment of substandard or impaired lives other than those which may be so considered on account of occupation or residence.

Life insurance began with the almost indiscriminate admission of lives of all ages and after a certain period of such experience it fell into the opposite extreme and all were rejected who were not up to a certain standard of health, one out of every three or four applicants, we are told, being rejected because an intense selection began to be exercised against the offices. It was but natural that the companies should finally direct their attention to this waste with an attempt to assess special rates upon some of the rejected risks. The first company to attempt this was the old Equitable which did so in 1762 with reference to persons suffering from gout or with hernia. The usual extra premium was 11 per cent or 12 per cent of the regular premium which provided for slightly less than 25 per cent extra mortality.

The next company of which we have record as insuring substandard lives was the Eagle Insurance Company which began in a small way in 1808. In how small a way we realize when it is known that from 1808 to 1813 they accepted only eight substandard cases, all of the risks being those "liable to gout" and in the last-mentioned year a person afflicted with hernia was accepted. From that time on more attention was given to the subject but until 1824 few standard risks were accepted other than those accepted with gout and hernia. Finally others were accepted with "affections of circulation" and "of respiration," "obesity," "intemperate habits," "family history or general want of robustness." How limited the business was may be realized when it is known that from 1813 to June, 1871, only 3,147 such risks were placed upon the books of the company, that is in a period of fifty-eight years.

In 1824 particular attention was directed to the subject by the establishment of the Clerical, Medical, and General Life Assurance Society for the purpose of granting "policies on lives deviating so much from the common standard of health as to render them wholly inadmissible to any office then existing." The experience of the first eleven years of this office gave a mortality of over double that on healthy lives whereas the average additional premium did not exceed 30 per cent. More caution prevailed during the next ten years with beneficial results as shown by the mortality experience then deduced with the result that invalid lives were accepted rather more freely than before. From what we know now of the subject many lives were accepted even in this subsequent period which would not now be considered insurable on any plan and the heavy general mortality was reduced by charging extra premiums on risks which would now be considered standard.

After the formation of the Clerical, Medical, and General a number of other smaller companies were formed and the practice of rating up or charging extra premiums became quite general. The system of rating was more or less haphazard and seems to have been based in a large part upon how much the local examiner considered the expectancy of the applicant to be reduced by the unfavorable features or in accordance with the increase in the hazard as determined by the managers of the offices.

The attitude of some of the companies, however, was unfavorable to the project which was regarded in the same light with which substandard insurance has been regarded in recent years by most of the companies in America. For instance, in 1828 William Morgan, in his publication, *View of the Rise and Progress of the Equitable Society*, stated, "I should be still more sorry to see the Society descend to the quackery of pretending to determine how many years shall be added to the age of a person, according as he is affected with asthma, dropsy, palsy, etc., in order to fix the premiums at which his life is to be assured." Many peculiar views were held in those days regarding the subject. For instance, in one prospectus it was set forth that at the age of 30 in the country districts the expectation of life was 36.7 years whereas in some cities, for instance Glasgow, it was only 27.6 years, or a difference of nearly 33 per cent. It was then set forth that the expectations of those who ultimately die of consumption in some of the country districts was 14.5 years whereas in the city of Glasgow it was 14.4 years. The deduction was, therefore, made that "the fluctuation in the mortality of diseased lives is much less than among select lives" and that "therefore the risk of assuring diseased lives must also be less"; that, for instance, if a table of mortality for select lives would indicate 100 deaths per annum it must "always have sufficient funds at immediate command to meet 145 deaths" while on the other hand "an office assuring diseased lives only need not provide for more than 109 deaths per annum" providing 100 deaths were expected by the table for diseased lives, "that is to say, the risk of assuring diseased lives is to that of average lives as 9 to 45, or only one fifth."

In 1845 the England Life and Invalid-Hazard Assurance Company was formed with the very interesting announcement that "the company would have their separate tables for effecting insurance on lives in full health: for hazardous, double, treble, and quadruple hazardous; and also for effecting assurances, for certain periods, on lives which may be considered desperate." The mention of the separate tables, hazardous, double, treble, and quadruple hazardous, is reminiscent of the method of classification of substandard risks with some companies in America today, although it does not seem to have made any progress.

In 1858 the London and Yorkshire Insurance Office was founded and in 1861 it commenced insuring "diseased and doubtful" lives under what was referred to in their prospectus as a "new scheme." In this prospectus attention was called to "parties rejected by other offices, or accepted subject to extra premium" to examine this new scheme and to that of agents as "to its applicability where parties decline to complete proposals under the old plan." Here we have the precursor of the modern substandard broker. This new plan was devised by Mr. Morrice A. Black, of the office just referred to, who prepared a pamphlet, *The Assurance of Diseased and Doubtful Lives on a New Principle, More Advantageous to Policyholders than the System Hitherto Adopted*, and so it was for the deduction was inadequate. In this prospectus Mr. Black stated that very little was known of the mortality on diseased lives; that there was little system in the methods adopted or equity in the terms of contract and that there was little uniformity in the charge by different companies for extra risk on diseased lives who, on the one hand, were examined in town and country by men of varying ability but upon whose opinions, nevertheless, great reliance was placed and who, on the other hand, were passed upon by those at the Home Offices who had great diversity of opinion as to the significance of the findings. He then proposed as a remedy "a plan that would make it absolutely certain that the extra premiums would be fully paid up in event of death occurring before a given age and a plan that would also make certain that the extra premium would be cancelled in event of surviving a given age." His method was to equate the present value of the extra premiums to a single premium for insurance for a period after which the full amount would be payable in event of death, a sort of single premium lien in which we find the first beginnings of the lien system.[1]

---

[1] "Diseased and Impaired Lives," *Walford's Insurance Cyclopedia*, II, 330.

In the following year Mr. Samuel Younger presented a similar idea before the Institute of Actuaries[1] in which he made the suggestion that "the extra premium proposed to be charged should be left unpaid until the expiration of the period termed the expectancy of life on condition that a certain deduction agreed upon beforehand be made from the sum assured if death happen in that period; no deduction to be made if the life failed after that term." Mr. Younger's paper was based on the fallacious assumption "as a *fundamental truth*, that the fact of a person whose life was considered an extra-hazardous one living to the end of the expectation period is complete evidence that the medical opinion was wrong and that no additional premium was necessary." As a result of Mr. Younger's principal fallacy the deductions found by him were only about half as great as those required by Mr. Black's method.

The lien method does not seem to have made much progress for some time and the companies continued for the most part to use extra premiums which were certain percentages of the normal premium or the alternative plan of having the medical examiner estimate how much he considered the expectation of life to be reduced by the unfavorable features and from this estimate assessing a rating-up in years. In 1871 from the record of 55 companies it was found that 2 did not do any substandard business, concerning 3 the information was indefinite, while 32 used the plan of rating up in years with valuation at the rated-up age, and 15 used the extra-premium plan with valuation at the true age. Only three companies used the lien plan as a result of Mr. Black's suggestion in 1861. Among these his company is not included as it had already passed out of existence.

In 1851 the Clerical, Medical, and General published its experience on diseased lives and in 1869 in connection with the well-known H^M experience was published the *Combined Experience on Diseased Lives* embracing only 11,146 lives and in 1873 the Eagle Insurance Company published its experience on diseased lives. In all of these experiences all heterogeneous types of risks were grouped together for the reason that there was not sufficient experience in any one type, for, as has been noted, the total amount of substandard business done was very meager.

---

[1] Samuel Younger, "A Plan for Making Conditional the Payment of Extra Premiums in the Case of a Life Supposed to Be Diseased or More Than Ordinarily Hazardous," *J.I.A.*, X, 268.

In a discussion before the Institute of Actuaries in 1874 the opinion was expressed that up to that time "hardly any of the companies had made the business pay" and that after fifty years of experience in several companies it seemed that "very little progress had been made and no real information obtained as to the proper premium to be charged." This was especially discouraging when the fact is noted that the basic premiums quoted for normal risks were very high and profitable and that many risks were granted insurance at increased premiums upon which there was no real extra hazard.

Not only was little progress made as to mortality values of special types of risks but there was little advance toward a comprehension of the true principles of substandard insurance. As evidence of this it is interesting to cite that in a paper delivered before the Institute of Actuaries in 1872 no less an authority than W. M. Makeham stated that when it is assumed that as a result of estimating the applicant's life, or rather expectation of life, as being diminished so many years and that as a result a premium rated up in years could be assessed to correspond with this estimate, the extra premium could be dispensed with entirely by granting endowment insurance. This was presumably on the astounding theory, which is hard to believe could be entertained by a man who otherwise understood so well the principles of mortality tables, that a limitation of the expectation of life would affect the later years only and that there would, as a result, be no extra mortality to be cared for in the earlier years.[1]

However, a brilliant ray of light occasionally appeared and Mr. Makeham's idea above referred to is even more understandable in view of the deductions of James R. Macfadyen in a paper on "Extra Premiums" delivered just three months before Mr. Makeham's paper. Many British actuaries were already beginning to realize that the rating-up-in-years method was not an altogether suitable one for handling the subject. In this paper Mr. Macfadyen enunciated the following very sound principle:

[1] W. M. Makeham, "Means of Dispensing with Extra Premiums for Deteriorated Health," *ibid.*, XVII, 155.

> So that in under-average cases, where it was assumed at entry that a premium equal to that for an average life t years older will cover the risk, it is probable that in the earlier years of the assurance we shall find the anticipated deaths exceeded by the actual—meaning by the anticipated deaths those which would be found by taking the probabilities of an average life t years older dying within the period. This, however, is of course no proof that the extra is insufficient, as the latter years will make up the deficiency, and the few who live long will provide for those who die early. If, then, in calculating the expected mortality of an Office with a number of under-average risks on its books of comparatively recent entry, these lives are taken as equivalent to ordinary lives t years older, it follows that the expected mortality and claims will be under-estimated; and the greater the extras that have been charged, the greater on the whole will be the deficiency in the estimate.[1]

Mr. Gerald H. Ryan in 1883 presented a very interesting paper on the subject of "Extra Risks" from which the following passage illustrates the unsatisfactory situation at that time:

> With many offices extra-risk assurances are of rare occurrence, and it will make no appreciable difference how they are treated. But there are other offices who specially seek such risks to swell their general business, to whom it is, perhaps, no very serious matter what extra premiums they obtain, and what mortality they experience, on such assurances, or how they are valued, as the extent of their business is so great that the mortality among the various classes is lost sight of. Let the mortality among the extra risks be as heavy as it may, and as disproportionate to the amount of premium charged, in the largeness of the figures the effect is not perceived. But it is surely not sufficient that the general result should be profitable: each distinct and clearly definable class of assurance ought, rightly, to contribute to the profits, and this can only be insured by separate analyses. It is, then, in the hope that the subject of extra risks may henceforth be considered more scientifically, that the present paper is brought forward.[2]

In a discussion of a paper by Messrs. White and Whittall on "Extra Mortality" delivered in July, 1884, the President of the Institute, Mr. T. B. Sprague, said

> he was much struck in reading the paper with the number of speculative remarks in it as to the possibility of the extra mortality among a certain

---

[1] James R. Macfadyen, "Extra Premium," *ibid.*, XVII, 82.

[2] Gerald H. Ryan, "Extra Risks, Considered in Relation to a Hypothetical Table of Mortality Based on the H^M Table," *ibid.*, XXIV, 19–39.

class of lives being constant, or increasing, or diminishing, and thought that it would have been better if an attempt had been made to determine from an examination of such statistics as have been published what law the extra mortality actually followed; but if the authors would on a future occasion give the results of their study of the other statistics they would be conferring valuable services upon the Institute.[1]

It will be recalled that it was in 1861 that the first attempt was made to issue lien policies on substandard risks. It was not until 1891 that Mr. A. W. Sunderland, in a paper read before the Institute,[2] demonstrated correct principles for arriving at the amount of deductions and in this paper he made the surprising exposition that the deductions provided by the usual company in their policy contracts were but a fraction of what they should be. This resulted from the fact that it was the common practice to take the extra premium, determined by the difference between the rated-up age assessed and the premium for the actual age, and multiply this extra premium by the expectation of life, the result giving the amount of deduction in case of death the first year. This initial deduction was reduced annually by the amount of the extra premium. It will thus be seen that after 130 years since the first attempt of the Equitable and nearly 70 years since the first attempt of other companies that comparatively little progress was made in the development of actuarial principles of substandard insurance although here and there an occasional sound view was set forth and this is also true of the statistical information. In all this time, except for some statistics relating to climate hazard and a few casual types of occupational risks, no statistical information was presented as to other types of impaired risks.

In 1892 Mr. Henry Manly presented the first of these in connection with Consumptive Family History.[3] Many of us who were accustomed to refer back to this for information prior to the Medico-Actuarial Investigation will be surprised by now referring to Mr. Manly's paper at the paucity of the data involved. There were only 863 cases in all, there being, for instance, only 63 where the father had died of consumption and only 71 where the mother had died of this disease. Naturally there was no classification for the important factor of build which is the determining one as to whether a favorable or unfavorable mortality will result.

---

[1] Francis William White, "Extra Mortality," *ibid.*, XXIV, 385–418.

[2] A. W. Sunderland, "A Method Frequently Adopted of Treating Under-Average Lives for Assurance Purposes, by Making Temporary Deductions from the Sums Assured," *ibid.*, XXIX, 419.

[3] Henry William Manly, "An Attempt to Measure the Extra Risk Arising from a Consumptive Family History When the Life Proposed for Assurance Is Physically Sound and Healthy," *ibid.*, XXX, 97.

In the United States, up to this time, practically no attempt was made in the substandard field aside from occupational risks. However, it should be noted that in Canada the Sun Life issued an occasional substandard policy prior to 1887, either with an extra premium or with a rating up in age. In 1887 that company issued its first lien policy but it was not until December, 1889, that it adopted the lien system as a feature of its business but it may be properly said that they were not really launched in the substandard field until this latter year. In these "early days there was very little experience to serve as a guide and the liens depended, therefore, upon the judgment of the Medical Director and Actuary as to the nature and extent of the extra mortality likely to be experienced."[1] After the introduction of the lien system the Sun Life did not use extra premiums or the rated-up method but the lien system was their sole method and this was "used in conjunction with the endowment plan to meet certain of the more serious classes of impairment such as heart murmurs." After the publication of the Medico-Actuarial Mortality Investigation the company commenced to use the rating-up system, particularly in connection with overweights, and since that time the rating-up method has been more and more used.

The development in the New York Life along proper statistical lines, as described by Dr. Rogers in his various papers,[2] lead to momentous results which almost entirely revolutionized the method of selection of risks. These statistical investigations were undertaken for the purpose of determining the acceptability for standard insurance of certain types of borderline cases but it was discovered when the resulting information was acquired that the means was at hand to begin writing substandard insurance "tentatively,'' to quote Dr. Rogers' phraseology, for discovery was made in these statistical investigations of a fundamental principle of life underwriting, namely, that the same principle is involved in assessing substandard risks their mortality ratings as in placing accurate valuations on borderline cases to determine whether these borderline cases should be accepted or declined for insurance by a company doing a standard business only. In other words, it is as difficult, if not even more so, to determine the proper action upon a borderline risk as it is to determine the borderline between, for instance, a 125 per cent and a 150 per cent risk. The statistical studies in the New York Life were begun in 1890 and by 1896 it found itself "in position to place definite valuations on a wide range of borderline and substandard cases and in July of that year the company took up the work of insuring under-average lives. At first this was done tentatively, constantly watching our experience, but later with increasing confidence that our standards were correct and our point of view sound." This company decided to adopt the rating-up-in-years method as a practical solution of granting substandard insurance, thus following the English method, the reserves and surrender values being based upon the rated-up age.

---

[1] Quotation from letter received from Mr. A. B. Wood, actuary of the Sun Life.

[2] Dr. O. H. Rogers, "Medical Selection as Influenced by the Specialized Investigation," p. 6; "Medical Selection and Substandard Business," p. 81; "Medical Selection," p. 214, in *Proceedings of the Association of Life Insurance Medical Directors of America*, 1907–1912.

The Travelers Insurance Company began writing substandard business prior to 1900 but its early contracts were practically all on the lien plan. However, in 1907 the company adopted the system of extra premiums based on percentage additions to the standard mortality table. This may be regarded as an epochal move in the history of substandard insurance for, considering the question from every viewpoint, this system is the most generally satisfactory of any that has yet been devised for dealing with substandard risks. On January 1, 1908, the Travelers Insurance Company published values as well as ratings according to this system.

The Equitable entered the substandard field about the same time as the Travelers, employing the rating-up method. Aside from the companies mentioned there was little substandard business done during the first decade of this century although there were a few attempting it in a limited way. The company with which the writer is connected began the writing of substandard business in a "tentative way" also in 1911, using the rating-up method but on July 1, 1914, it adopted the system based on percentage additions to the standard mortality table, being the second company to adopt this system. The next company to adopt this system was the Equitable on July 1, 1915.

In this connection it should be noted that the Security Trust and Life of Philadelphia was organized in the early nineties to do a substandard business exclusively, securing its business through brokering with the agents the rejected risks of other companies. It employed at first, for the most part, the lien system but soon after adopted the rating-up method. When the Security Trust and Life was reinsured by the Pittsburgh Life and Trust in 1907 the latter company entered the substandard field, using the rating-up method.

II. PRINCIPLES

The principles involving the handling of substandard risks for convenience of treatment may be divided into three groups:

First, those relating to the classification and rating of risks;

Second, those relating to the determination of the premium rates to be charged on risks so rated and classified and to the determination of proper form of contract, and

Third, general considerations.

I. CLASSIFICATION AND RATING OF RISKS

The procedure as to the classification and rating of risks will doubtless, to a greater or less extent, vary according to the personnel of the individual company and the stage of the development of substandard business in the individual company. A great variation in the mortality experiences of individual companies on standard business from the aggregate experience of all companies combined has already been noted on various occasions and naturally this will be much more true in connection with substandard insurance where we not only have the same conditions which cause variation in standard mortality but a greater tendency toward fluctuation and, in addition, a much wider range of fluctuation due to the peculiar difficulties in interpreting a more complicated material.

It seems absolutely necessary that each individual company work out by evolutionary methods its own substandard system according to the conditions and equipment applicable to it. That is true of the New York Life, as we have already noted, and also of other companies doing substandard business over a period of years, including the company with which I am connected. Two large and very important companies, one of them which has always been known as a rigid selector of risks, have recently announced their intention of entering the substandard field and both of them have included in their announcements that they will begin in a limited way at first.

Mortality ratings for substandard aspects must be carefully considered to suit the individual needs of the individual companies desiring to make use of such ratings. The ideal way of instituting these methods and supervising their operation is by an underwriting board on which may be represented the medical staff, the actuarial, and the experienced insurance executive who has a wide understanding of the principles of life insurance and the operations of a life insurance company. The keynote of the situation is to have the board directed by such executive, particularly if he is well versed in mortality tables, mortality values, and has a keen sense of proportion and of probabilities, with long experience in dealing with the mortality qualities of risks. As has been implied, he should be accustomed to viewing things more particularly in the mass or as a class rather than from the individual point of view and he should have no fear in his soul, but at the same time he should be conservative where conservatism is required.

It is hard to conceive of the prosecution of substandard business along practical and successful lines without the use of The Numerical Method of rating. By *The* Numerical Method is not meant *a* numerical method limited in its scope according to which certain percentages are rigidly assigned to the various insurance aspects of a risk and then rigidly assessing the risk in accordance with the mortality charge resulting from the rigid summation of the mortality values for these factors. This rigid summation method, which is indeed *a* numerical method, is the conception of many as *The* Numerical Method, which is condemned in many quarters. The Numerical Method is a broad and telling process of arriving at a numerical factor as the mortality value of a risk with some reference to incidence, particularly in certain types, and, while it indeed may in many cases be the summation of the factors for the individual aspects it may involve extra percentages added for certain combinations which cause extra hazard or it may even have deductions from the sum of the factors for two or more aspects which in individual cases may not be mutually exclusive and it may also involve an adjustment after the summation is completed if the results arrived at are found to be inconsistent after reviewing the various influencing factors in combination.

To summarize, The Numerical Method may be defined as the method by which an attempt is made to affix a numerical value to the risk as a whole by the employment in so far as possible of definite fixed standards for the various aspects of the risk. The Numerical Method may or may not involve the consideration of the incidence of mortality.

Able actuaries have criticized The Numerical Method not only on the supposition that it represented a rigid summation but also upon the theory that those employing it would accept bodily the mortality percentages from mortality experiences wherever they were found without proper interpretation. For instance, a number of years ago a case like this was cited to prove the inconsistency of The Numerical Method:

A printer, age 30, 5 ft. 10 in. 147 lbs. residing in Arapahoe County, Colorado, father died of phthisis at age 45; has pulse rate below 60, and has had blood-spitting:

Basic Rate 100	Numerical Value of Risk
Build and family history	−13
Occupation	−20
Low pulse rate	−30
Has had blood-spitting	− 8
Habitat	−18
Deficiency	−73
Standard or basic risk	100
Total value of risk	27 Per Cent

In the first place the percentage for build and family history was abnormally low for the reason that the risks involved were very rigidly selected as the business for the most part had been accepted by companies doing a standard business only. Even today the companies would employ a rating of about +10 instead of −13. The same is likewise true of the occupational rating. The companies using The Numerical Rating will use a factor of +15 instead of −20. The −20. experience was on a class of risks superselected on account of the fact that an increased mortality was expected upon printers. No conservative company would give a credit of 30 for low pulse rate although they would doubtless give some credit. The material as the blood-spitting in the Specialized Mortality Investigation was notoriously non-homogeneous. A great deal would depend upon the weight and age of the applicant and the duration since the attack. The cases embraced in the Specialized Mortality Investigation were superselected and not only was it questionable whether much of the blood-spitting was authentic but the duration since attack must have been long and most of the applicants overweight. Furthermore, no credit would be given for residence in Arapahoe County, Colorado. The foregoing example is cited to call attention to the fact that all mortality statistics must be very carefully interpreted and then adapted to the requirements of the Numerical System.

In the classification of risks a question of incidence of mortality must also be borne in mind. This will later on be referred to under the second heading, Premium Rates and Form of Contract.

2. PREMIUM RATES AND CONTRACT FORMS

Mr. George Graham, in a recent effective paper on Substandard Forms of Insurance delivered before the last meeting of the Medical Section of the American Life Convention, sets forth the following methods of dealing with substandard risks as to premium charge and form of contract:

A. Extra premium per $1,000 of insurance, which extra shall be the same for all ages at entry.

B. Temporary liens against the sum insured, constant or decreasing, or a combination of these.

C. Advance in age.

D. Extra premiums based on percentage additions to the standard mortality table.

E. Limiting the plan to short-term endowments or life forms with terminating options at the end of a term of years.

F. Special dividend classes.

From the point of incidence there are six types of mortality or perhaps a more careful expression might be "types of mortality tendency," as follows:

a) Constant extra mortality
b) Gradually decreasing extra mortality
c) Rapidly decreasing extra mortality
d) Constant extra percentage of mortality
e) Gradually increasing extra percentage of mortality reaching a maximum and then slowly decreasing.
f) Constantly increasing extra percentage of mortality rating, reaching a maximum late in life.

A. Extra premiums.—Those risks whose extra mortality approximates the constant throughout life may best be dealt with by an extra premium charge under method A. This is typified by the occupational risk where the hazard is entirely or almost entirely of an accidental nature. While the risk per thousand of insurance is a decreasing one owing to the increase in reserve and therefore the theoretical reserves are somewhat less than the normal, it is probably most feasible to carry reserves and grant surrender values based upon the regular reserves for the true age. It is usually customary to charge a smaller extra premium for endowments running for twenty or twenty-five years or less owing to the fact that the net amount at risk is considerably reduced as compared with that on the life plans, as well as the fact that a better type as a whole apply for endowments.

Another type of mortality which may be adequately dealt with by the extra premium method is the rapidly decreasing risk such as those, for instance, with a history of gastric or duodenal ulcer or history of appendicitis without operation. After a few years these risks tend to become normal and therefore they should not have any extra premium payable after that time for the reason that insurance may be effected in other companies at standard rates. It is effective to charge this type of risks extra premiums running for a certain period of years according to the severity of the impairment. While the risk is decreasing rapidly, nevertheless it is usually customary to charge a flat extra throughout the term of years although theoretically it would be more proper to charge a decreasing extra premium but careful observations of all the theoretical considerations of the subject would cause substandard practice to become more complicated than would be practicable.

B. Liens.—Theoretically, decreasing extra mortality, as exampled in the case of very lightweights, particularly at the younger ages, or lightweights with consumptive family history, and also by those with a personal history of disease causing serious physical impairment such as gastric ulcer or history of tuberculosis or blood-spitting, could be handled effectively by means of decreasing liens, but what applicants for insurance require is protection and this is not accomplished adequately by means of the lien. Increased premiums should be used wherever feasible in order to grant this protection. However, there are many types which should be assessed for such a considerable extra mortality that the additional premium would be prohibitory. This applies to the risks which are rated in excess of 200, 225, or 250 per cent. Therefore with these it is practically necessary to resort to the lien method, granting policies at increased premiums where the hazard is less than for these types unless a lien form should be particularly requested.

For many years it was supposed that if the option between an increased premium policy and lien policy were granted to an applicant there would be a selection against the company through the best type of risks taking the lien policy and the poorer type taking the extra premium policy, but practical experience has demonstrated that this is only theoretical. Mr. Frederick W. Frankland, many years ago before the Institute of Actuaries, stated that the practice of choice had been customary in New Zealand for many years but they had very wisely discontinued the use of the lien policy for the reason that it was seldom selected by the applicant where a choice was given. Mr. Robert Henderson, a few years ago before the Actuarial Society of America, stated that this had been the actual experience in his own company. They had granted this choice over a period of many years and practically no lien policies were selected. The agents of the writer's company have been instructed that where increased premiums have been assessed the applicant may have the choice of a lien policy, but in spite of this option the lien policy has been selected in only one or two such cases.

Reference has previously been made to the fact that while the first lien policies were issued in 1861 it was not until 1891 that correct principles were demonstrated by Mr. Sunderland for arriving at the amount of the lien.[1] In his paper Mr. Sunderland demonstrates the formula for determining the lien which is equivalent to a certain rating up in years, the lien to begin with an initial amount and to decrease annually by equal amounts throughout the expectation of life. By Mr. Sunderland's formula the initial amount is determined and the amount of equal annual reduction.

The subject was still further treated by Mr. George F. Hardy.[2] In his paper Mr. Hardy calls attention to the fact that one of the assumptions upon which the lien principle is usually based is "that the extra risk is so distributed throughout the above mentioned period [i.e., during the expectation of life] that the reserve value of a policy subject to such temporary deduction is the same as that of an ordinary policy of the same age at entry and duration." In this country we have also followed the same assumption as to reserve values on lien policies. However, it has been customary on this side of the water to reduce the lien by the amount of the annual premium and Mr. Hunter in his paper on "Underaverage Lives"[3] discusses this type of lien and gives tables showing the amount of extra mortality provided for by liens of $300, $500, and $700 on the Ordinary Life, Twenty-Payment Life, and Twenty-Year Endowment plans, giving the method by which he arrives at his results. For convenience of reference is given herewith the table on page 69 of Mr. Hunter's paper showing the amount of the mortality borne by the various liens on the basis of the American Table of Mortality with $3\frac{1}{2}$ per cent interest, the lien to be decreased annually by the amount of the premium payable.

It will be seen from the table that the liens for the smaller amounts provide for very little extra mortality and in practice it will be found much more feasible to grant the full amount of insurance at increased premiums, not only for the reason that such type of contract is much more acceptable to the applicant, even at a considerable increase in premium, but also it is necessary to pursue this course in order to secure adequate contribution to the cost of insurance. Liens are really feasible in practice only where the anticipated extra mortality is in excess of 200 per cent and then resort may be had to endowments with heavy liens, in many instances the liens being $700 or $800, constant for the first few years and then decreasing by equal amounts so that toward the end of the endowment period the full face of the policy is payable. By this method at the younger ages, particularly under 40 or 45, mortality for 300 per cent, 400 per cent, or even 500 per cent may be provided for in acceptable policies. The experience during the past year of the writer's company with this type of policy is that approximately 50 per cent of them were paid for, even in spite of the heavy lien and the fact that the form of policy had been limited to an endowment. It might be well to add that in either event the commission to the agent would be the same.

---

[1] Sunderland, *loc. cit*

[2] George F. Hardy, "On a Method of Computing the Temporary Deductions to Be Made from the Sums Assured upon Rated-up Lives, in Lieu of Extra Premium," *J.I.A.*, XXXII, 153.

[3] Arthur Hunter, "Underaverage Lives," *T.A.S.A.*, XVI, 64.

	Lien Per $1,000	Percentage of American Mortality Borne by Line		
		Age 25	Age 40	Age 55
		Per Cent	Per Cent	Per Cent
	300	9	6	5
Ordinary Life	500	31	22	17
	700	92	65	49
	300	9	7	5
20-Payment Life	500	28	23	18
	700	78	69	52
	300	11	9	6
20-Year Endowment	500	39	33	21
	700	120	99	60

While it is reasonable to grant these lien policies on the assumption of Mr. Hardy referred to above, namely, that the extra risk is so distributed that the reserve value is the same as for a standard policy, so far as the status of the policy is concerned when it is in full force and effect by the payment of premiums or in so far as the cash surrender value is selected in case of termination, yet difficulty is encountered as to the paid-up endowment insurance value. If the regular amount of paid-up endowment insurance is granted, the allowance is too large owing to the heavy mortality involved but it is not practicable, on the one hand, to place a decreasing lien against this endowment insurance owing to the requirements of the laws of the various states and, on the other hand, the amount of the endowment cannot be scaled owing to the limitation by law of the surrender charge nor can a reduced amount of paid-up endowment under this plan be provided for since the basis of mortality indicated in the policy is that by the regular American Experience Table. This unsatisfactory dilemma may be met in a satisfactory manner by basing the policy with reserves and surrender values on special tables of mortality providing for percentage additions to the standard mortality; for instance, providing for a total mortality of 300 per cent, 400 per cent, or 500 per cent. This, too, is consistent with the basis upon which the risk has been rated according to the Numerical Method. The method is to so arrange the liens that the premium for the lien policy on the extra percentage table will be approximately the same as that for a standard risk at the same age.

It has been stated time and again that liens are especially applicable where the increased mortality is of a temporary nature and disappears in the course of time as in the case of consumptive family history or such medical impairment as recent appendicitis without operation or recent history of gastric ulcer. While with such types of impairments the extra mortality may be covered by a lien of reasonable amount on life policies, yet it will be found that the increased premium method will be more acceptable both to the insured and the company and consequently here, too, the lien policy has not much practical value.

Reference should be made to the fact that, while throughout this paper policies with liens have been referred to, yet the laws of practically all the states prohibit the issuance of lien policies under that section of the Standard Provision Acts that there shall be no provision in policies providing for any settlement of less than the face of the policy. It is, therefore, necessary to write these policies in the form of increasing insurance on their face.

A further interesting discussion on the subject of liens may be found on pages 497 and 498, Volume XLI, of the *Journal of the Institute of Actuaries*,[1] and also on page 266 and following of Volume XLIX of the *Journal of the Institute of Actuaries*.[2]

---

[1] H. E. W. Lutt, "On Extra Premiums," *J.I.A.*, XLI, 461.

[2] Ralph Todhunter, "Two Notes on Questions of Office Practice," *ibid.*, XLIX, 254.

C. Advance in age.—Attention has already been called to the fact that British actuaries many years ago were beginning to realize the inadequacy of the rating-up-in-years method. A criticism of this method by Mr. Macfadyen quoted on page 000 above is very adequate and sound. The insuring company receives too small contribution in the earlier years to the mortality fund and if the reserves are set aside for the rated-up age the reserves are always unnecessarily high and in case of withdrawal the withdrawing policyholder has left behind insufficient compensation for the risk incurred. To illustrate this defect in the contribution to mortality let us consider the following example: Assuming that a company issues ten millions of substandard insurance, that of this five millions is Ordinary Life, four millions Twenty-Payment Life and one million Twenty-Year Endowment; if it computes its premiums and reserves on the basis of 150 per cent mortality the expected mortality the first year will be $124,330. Assuming the mortality to be 40 per cent the first year, the expected death losses will be $49,732. On the other hand, if the company grants its insurance to these same risks by the rated-up-age method the expected mortality will be only $93,830 and the same death loss will give a mortality of 53 per cent of the expected. A discussion of some of the inconsistencies of the rated-up method may be found in Volume VII, page 87, of the *Record*.[1]

Mr. Graham, in his recent paper above referred to, discusses at considerable length the inconsistency of the advance in age method. It will be recalled that the usual way of applying the advance in age method is to find at an advanced age the premium equivalent to that providing for a constant extra percentage of mortality upon which basis the risks are usually assessed or classified by the Numerical Method. This equivalent premium at the higher age determines the rating up in years. Mr. Graham calls attention to the fact that the rating up at age twenty on the Life plan to give a premium equivalent to a 150 per cent premium is eleven years and that the policy accordingly, by the advance in age method, is issued as of age thirty-one. However, the first year only 9 per cent extra mortality is provided although the risk is classified as a 150 per cent risk. Even in the sixteenth year there is provision for only 29 per cent extra mortality. No greater inconsistency of treatment could well be imagined and when it is considered that according to the experience of some companies the maximum extra mortality on substandard business is incurred the third or fourth policy year, it is realized in what a hazardous position a company is placing itself by using the advance in age method unless it is extremely well entrenched financially. It is bad enough to employ this method on Life and Endowment forms with the ultimate hope of some reimbursement from excess interest earnings later on. This hazard is accentuated beyond all bounds when an attempt is made to do the rating up in age on Term plans.

---

[1] Franklin B. Mead, "Surrender Values in Policies on Substandard Lives," *Record of A.I.A.*, VII, 87.

Mr. J. Burn made an interesting comment on the advance in age method in his discussion on Mr. Lutt's paper above referred to when he said, in part, as follows:

> The author had stated that in his opinion the manner in which under-average lives were treated was a matter of "experience." Perhaps some actuaries would have to acknowledge that it was rather lack of energy than expediency which prevented them from attempting to find out what really should be done in order to arrive at some more scientific basis for the treatment of under-average lives. He thought it could be shown by sound reasoning that there was practically no extra mortality (such as the actuary was in the habit of dealing with) which assumed the form provided for by rating up a certain number of years. The method assumed a constantly increasing extra strain, but such a strain, he believed, was practically unknown.

However, Mr. A. A. Welch has demonstrated[1] that overweights may be adequately dealt with by the rating-up-in-age method. This is because the overweight mortality is an increasing extra percentage over the normal. However, if too many methods of dealing with substandard risks are employed in the individual company the system becomes too complicated for practical use in the field as well as for administrative work at the Home Office.

D. Extra premiums based on percentage additions to the standard mortality table.—For the general group of substandard cases, except those showing a constant extra mortality such as occupational risks hazardous on account of accident and risks with medical impairments which rapidly decrease, increased premiums based on percentage additions to the standard mortality table seem best suited. In this group may be thrown all the miscellaneous types, those with gradually decreasing extra mortality such as lightweights at the younger ages with consumptive family history, those with a constant extra percentage of mortality such as cases with heart murmurs, those with medical impairments where the mortality increases for a number of years and then slowly decreases, and those with an increasing extra percentage of mortality such as overweights, for instance. It is quite probable that by grouping all these types together not only will the constant extra mortality ensue but the method of rating will be harmonized with the Numerical Method of assessment of risks.

---

[1] A. A. Welch, "A Practical Rating for Overweight," *T.A.S.A.*, XVII, 17.

E. Limiting the plan to Short-Term Endowments or life forms with terminating options at the end of a term of years.—The correctness of the theory of limitation to Short-Term Endowments or Life plans with terminating options at the end of a term of years including the termination of the sum insured has probably at last been exploded once for all although we still now and then hear of a sporadic advocate.

It is quite apparent that there is no provision for extra mortality in the endowment premium or any other premium based on the standard mortality table. Consequently the soundness of the limitation to plan can be correct only on one of two theories. The first is that there is considerable extra mortality after the end of the endowment period, i.e., more than is safely provided for by the standard table, and that during the endowment period such a condition does not exist. No one has ever located in theory and practice such a mortality type. The company that the writer is connected with prepared a number of years ago a life form with terminating options but no use was ever found for them for the reason that no type was ever isolated to which that form of policy would seem to appropriately apply. Many companies have attempted the limitation of plan method and practically all the experiences which have been compiled on such type of business indicates that the mortality is fully 50 per cent in excess of the average mortality of the company as a whole. The other theory is the increased losses will be compensated by the excess interest earnings on the increased reserve but if the matter is studied it will be found in the early years that but little additional mortality will be provided for. Furthermore, if this theory were correct standards risks are being overcharged for endowment insurance and therefore are equitably entitled to some reduction in premium as compared with the charge for the substandard risks modified to the endowment forms. This is an argument *reductio ad absurdum* for we are thus brought back face to face with the increased premium method.

F. Special dividend classes.—It is scarcely worth while to consider the treatment by special dividend classes inasmuch as deferred dividends are prohibited by the laws of most of the states and thus this method is not practicable although it may be used successfully for types of risk moderately substandard.

III. GENERAL CONSIDERATIONS

The question has arisen as to the use which may be made in substandard practice of the American Men Table, or a similar standard table such as that prepared in connection with the Medico-Actuarial Investigation. Inasmuch as the experience in the special classes of the Medico-Actuarial Investigation was based on policies, it is more appropriate to use for comparison a standard table based on policies and, therefore, the Medico-Actuarial standard table should be used as a basis of comparison. However, since we are interested in financial results it would seem to be more appropriate to compile special mortality experiences according to sums insured as well as policies and compare the results with the American Men Table which is based on amounts.

Some companies which use the rating-up-in-years method also employ either a table based on their own experience or some other table, for instance the standard table of the Medico-Actuarial Investigation or the American Men Table, to determine the number of years' rating to apply to their regular schedule of premiums to assess the premium rates for substandard risks. This method appears to the writer to be unsound for two reasons: in the first place their reserves are based upon the American Experience Table and this is really true of their premium rates although the loadings or, in the case of participating companies, their dividends may be graded with reference to a standard table such as the American Men Table. That system being followed for standard risks, it does not seem clear why the same principle should not be followed with reference to substandard risks which are classified according to extra percentages as compared with standard risks. There are some, however, who claim that, while it is preferable and even proper to use the American Table to determine the rating-up in years for non-participating companies, a special table like the American Men Table should be used by participating companies inasmuch as the dividends are graduated with reference to a table similar to the American Men. It seems to the writer that the same principle holds with reference to participating insurance as for non-participating and that the dividends may be adjusted for substandard risks in the same manner as they have been for standard risks. In other words, inasmuch as the American Experience Table practically controls for standard risks why should it not control for substandard risks in order to obtain equity between substandard and standard risks?

The objection to this method particularly arises in connection with the rating-up-in-age system for by it the objections to the rating-up-in-years system are still further accentuated owing to the fact that the special standard tables, such as the American Men Table, have a steeper curve than the American Table at the ages at which insurance is effected, and, therefore, the resulting years in rating-up are less than by the American Table and hence there results a still more inadequate provision for mortality at the younger ages than would obtain if the American Table were used to determine the years of rating up. For instance at age twenty the American Men Table requires three years less rating to secure the various extra percentages of mortality than does the American Table and at age thirty-five two years less. At age twenty, to provide an ultimate aggregate of 150 per cent mortality, the use of the American Man Select Table would secure a rating up of eight years which would provide only 6 per cent extra mortality the first year and only 19 per cent in the sixteenth year. It is hard to understand how this practice which results in this meager mortality provision can be justified from any standpoint.

One of the smaller companies, recently embarking in the substandard field, has announced its intention of basing the extra premiums for substandard risks upon the American Men Table. That is, upon the extra premium obtained by comparing the standard premiums according to the Men Table with the premiums resulting from those based on percentage additions to the mortality of the American Men Table. It is not quite clear to the writer why the same relative margins should not be employed for substandard risks as for standard risks, or rather why smaller relative margins should be ventured for substandard risks than for standard risks. By this system if the assessment of substandard risks is correct there will be no mortality salvages on the extra risk; i.e., in the long run the extra mortality with a favorable experience will be entirely consumed. That, in fact, is just what is being experienced in the older entrants for the reason that the ultimate mortality after age fifty-five is as high or greater than the American Table. Companies have recognized this fact by either providing a special loading at the higher ages in the case of non-participating companies or by adjustment of the dividend factors in the case of participating companies. It would seem to be even more incumbent to have this margin of safety in connection with substandard risks than in the case of risks at the higher ages for we know more about the mortality of the latter than we do of substandard mortality.

Commissions.—From time to time there has been some discussion as to whether the regular commissions should be paid on the increased premiums. It seems to the writer that this should depend somewhat upon what the regular commission is. For instance, it is probably quite right for a company whose scale of commissions is the moderate one of about 55 per cent graded to grant a commission on the increased premium, but it should be remembered that the scale of commissions of most of the smaller companies is about one-fourth higher and even more, and it would seem to be a proper, not to say laudable, means to ameliorate this higher cost by not allowing commission on the increased premium.

Reserves.—If the terminal reserves for normal risk are carried and the entire increased premium is used to take care of current mortality it is quite probable that the reserves will be insufficient for the general group of substandard risks. Therefore it is better to use the reserves by the extra percentage tables which are intermediate between those for normal risks and those based on the rated-up age. This, at any rate, is the more conservative practice through the fact that the reserves, on the one hand, are not excessive as in the rated-up-age method and at the same time are not subject to the criticism of possibly being inadequate as in the case of reserves for the actual age. Furthermore, this method would assist the agent in the delivery of substandard policies for the reason that it is a very good "talking point" to present to the applicant the fact that he is getting increased surrender values for his increased premiums.

Looking at the subject from another point of view, increased reserves for substandard risks seem to be required. Heart murmur, overweight, and albuminuria cases constitute in general about one-half of the substandard risks. The published experience of the New York Life indicates for heart murmurs a constant extra percentage of mortality and we know from the Medico-Actuarial Experience that overweights show an increasing extra percentage of mortality. Albuminuria cases, with which may be grouped cases with high blood pressure, probably show a constantly increasing percentage of extra mortality for a number of years and those with a history of syphilis show an increasing percentage of extra mortality and the same is probably true of goiter cases. These are all large groups constituting the preponderance of the substandard cases which, individually and as a group, reflect an extra percentage of mortality throughout the greater period of life. When it is considered that thus from these and other groups there will be withdrawals either by securing more favorable terms of insurance elsewhere or by reduction in the rating under the original policy, the need for increased reserves is even more apparent. The large group of those engaged in unhealthful occupations also require reserves at least as high as those provided for by extra percentage tables of mortality. The greater portion of the business of the smaller companies is on Limited Payment Life plans and if no increased reserve is accumulated during the premium-payment period there will be no provision for extra mortality after the expiration of the premium-payment period. This aspect adds weight to the argument that increased terminal reserves should be accumulated on substandard policies.

Improvement of the risk.—If a risk should improve so as to become standard on the one hand or entitled to a more favorable substandard rating, it does not seem to the writer that there is any other course to pursue than to grant the more favorable rating to which the risk is entitled as a result of the improvement.

It frequently develops that knowledge that the risk has become standard is due to the acceptance for standard insurance in another company and unless the risk is reconsidered and a standard policy granted, the original policy will usually be surrendered and if, therefore, the company originally granting the substandard insurance is not willing to re-write the insurance on a standard basis it is likely to be in the position of refusing to continue on its books a risk which it would be glad to accept for standard insurance if a new application were being presented which, of course, is an inconsistent position even though it might be contended in theory that the original ratings did not provide for the withdrawal from the substandard class of the improved risks. The only practical procedure is to so arrange the ratings that in case of improvement of the risk the increased premium will be reduced in accordance with the new conditions. Of course even if a risk were subsequently granted standard insurance in another company and if even at that time the risk could not be considered standard in accordance with the original company's usual practices, it is the part of underwriting consistency to decline to reduce the rating. The system, however, should be so arranged to provide for reduction in rating in case of improvement of the risk.

Owing to frequent withdrawals in this manner from the substandard class of the better type of risks it seems all the more consistent that increased reserves should be provided for since by this procedure the mortality in the substandard classes is increased by these withdrawals.

Where policies are granted at an extra premium, either temporary or permanent, and the reserves are carried at the true age, adjustment of the change is very simple for all that is necessary is to reduce the premium. If, however, reserves are carried and values granted at a rated-up age or in accordance with an extra percentage of mortality, or are based upon some special table of mortality, the policy change becomes complicated. The consistent way in such instances seems to be to reissue the policy as of the original date with values adjusted so that they will be the same as those which would have been granted originally had the insured at that time been in the same condition as at the time when adjustment is made, the same being true as to the premium rates. This on life plans will result in reduced reserves but the amount of reduction may be considered as a contribution to the company's mortality fund to compensate the company for the deterioration of the class from which the adjusted insured has been withdrawn.

One large company which takes business on the rated-up-in-years plan pursues this same course if the adjustment takes place within three years but after three years the advance in age is so reduced that the premium is that for the attained age. For instance, if the insured were thirty years of age and were rated up nine years and a reduction is made at the end of six years, it is the practice to reduce the rating-up to six years, that is as if the insurance had been granted at the attained age six years before; It is stated that the reason for this practice is that "after a reasonable period the insured should not be given full advantage of his improvement in health because the company cannot charge increased premiums in cases where an impaired risk has further deteriorated." If the insured is clearly a standard risk he can secure a policy for his actual age, thirty-six, in another company and he can surrender his original policy in the other company and have a policy in the new company at the same rate which would be granted in the other company and have the benefit of the cash surrender value on his policy in the original company. The practice of the company in question does not seem, therefore, to be altogether consistent.

Change to more favorable occupation.—In case of change to a more favorable occupation it is usually customary to grant a change in rating after a probationary period of one year for it frequently happens that change in occupation is not permanent. It is usually customary to require a medical examination or some sort of affidavit as to good health on the principle that the extra premium is charged not only to cover the risk while engaged in the hazardous occupation but also to cover the risk of becoming deteriorated while so engaged.

Extended insurance.—The great disadvantage in the rated-up method is the necessity of eliminating the extended insurance in many cases. Not only is the reserve allowance excessive but when this excessive amount is applied to purchase extended insurance according to the standard table at the rated-up age this excessiveness is greatly amplified for the reason that an insufficient cost of insurance is applied to determine the extended insurance. In many cases, particularly at the younger ages and at the shorter durations even up to ten or fifteen years, extended insurance is granted for a term almost twice as long as it should be. This objection is frequently met by the elimination of extended insurance entirely and sometimes inadequately met by granting it if the rating up does not exceed, say, five years. Even when the increased premium by the extra percentage table is converted into an extra premium and regular standard reserves and values for the true age are granted, the term of extended insurance is considerably greater than it should be. This dilemma is entirely eliminated by granting the values according to the extra percentage mortality tables for in that event it is just as consistent to grant extended insurance on substandard risks as it is on standard risks.

One of the most desired features in connection with substandard insurance is to place as large a proportion of the policies as possible in order to reduce to a minimum the selection against the company and if extended insurance is granted this situation is greatly helped.

UNDERAVERAGE BUSINESS WITH SPECIAL REFERENCE TO THE PROBLEMS OF A YOUNG COMPANY

BY ARTHUR HUNTER

Your president has asked me to present a paper on the problems which confront a young company with regard to issuing policies to applicants who may be underaverage risks on account of occupation, physical condition, family history, or other causes. It would be impracticable to deal with all of these problems, and, accordingly, the following have been selected: (1) Should a young company issue policies on underaverage lives? (2) From what sources should the necessary information be obtained for developing the plans? (3) What method of meeting the expected extra mortality should be adopted? (4) Should the surrender values be modified under policies issued to underaverage risks? (5) How should the policyholders who improve as risks be treated? (6) What should be the maximum of insurance taken on each risk? (7) Should the same scale of commissions be paid on substandard as on standard business? (8) How should the company keep its records of mortality so as to know that the underaverage business is safely conducted?

SHOULD A YOUNG COMPANY INSURE UNDERAVERAGE LIVES?

The answer to this question will depend on the number of years the company has been in existence, its financial standing, and the ability of the officers to handle the problems connected with underaverage lives. The officers of a company which has been in existence for a very few years would be well advised to confine the writing of business to standard lives, and in the meantime to collect all possible information regarding substandard risks. There are likely to be wider fluctuations in the mortality experienced among substandard lives than among standard lives. Assuming that the company's financial position would enable it to stand a heavier relative mortality for a few years among the former than among the latter, the next step is to determine whether or not the organization is equipped to prepare the necessary plans and to make a selection based on knowledge and not on impressions? In some of the younger companies the business is not large enough to employ a medical director for his whole time, and accordingly a practicing physician is put in charge of the selection of risks. Such a physician is inclined to look upon each life as an individual, instead of as one of a group; and many have neither the time nor the inclination to make a thorough study of the literature covering the selection of risks.

The following considerations should therefore be taken into account in determining the advisability of issuing underaverage policies: Have the necessary statistics been collected and thoroughly analyzed? Are the medical and actuarial departments in a position to base their plans on the best available information, and have they sufficient knowledge to use correctly such information? Are the medical director and the actuary ready to co-operate intelligently and frankly? If so, and if the company's financial standing is beyond peradventure, an underaverage business on conservative lines may be undertaken. It may be best to enter the field gradually, taking up, in the first place, the more common impairments on which reliable statistics are obtainable, and extending the scope to other impairments as experience is gained.

FROM WHAT SOURCES SHOULD THE NECESSARY INFORMATION BE OBTAINED?

There is now available a large amount of information for the conduct of underaverage business. I find frequently, however, that many who ask for information have not studied the existing material on the subject. Such material appears principally in the *Transactions of the Actuarial Society of America*, and the *Proceedings of the Association of Life Insurance Medical Directors*, but, unfortunately, the latter are not printed for public distribution. Too often the mistake is made of reading the original paper without studying also the discussion thereon. In the course of the discussion are given not only the opinions of actuaries and medical directors regarding the point of view of the writers of the papers, but often the experience of other companies. For instance, in a discussion of a paper by Dr. Toulmin and Mr. Perrin on "Asthma, Renal Colic, and Pleurisy," the experience of the Equitable on these three types of impairment is given. Again, those who discuss the papers frequently give information of great value on other impairments. For example, in the discussion of a paper by Dr. Rogers and myself, on the "Ratings for the Principal Medical Impairments," Dr. Rockwell and Mr. Henderson gave their ratings for a history of lung trouble and also for a history of pleurisy, neither impairment having been mentioned in the parent paper. I therefore strongly urge all those who are looking for information as to the treatment of underaverage lives to read carefully the discussions of the original papers.

In a paper entitled "The Problem of Insuring Underaverage Lives," delivered before the American Life Convention in October, 1921, Mr. Charles H. Beckett gives a comprehensive bibliography. In the recommendations of the Educational Committee of the Acturial Society of America also appears a list of the papers which the student is expected to read.

METHODS OF MEETING THE EXPECTED EXTRA MORTALITY

The three principal methods of meeting extra mortality, in use in this country, are (1) a lien against the amount payable at death; (2) an extra premium; (3) an advance in age. In some companies two of these plans are in use, and an attempt is made to fit the method to the individual case. For example, where the extra hazard is expected to be experienced largely in the early years and to disappear rapidly thereafter, a lien method is used; and where there is an occupation hazard which is considered to be a constant irrespective of age, the extra premium method is convenient. In general, however, the disposition seems to be to adopt one method for all types of hazard, partly for the sake of simplicity, and partly because sufficient data are not available to determine the incidence of the mortality for each impairment.

Before dealing with the different methods of meeting extra mortality it may be well to point out that, among underaverage risks as a whole, the ratio of the extra to the normal mortality decreases with the duration of the policies.

Lien system.—At one time there was a feeling in this country that the best method of providing for extra mortality was by means of a lien decreasing by the premiums paid. There has been in recent years a marked loss in the popularity of that method. This may be due to a realization that a decreasing lien of reasonable size does not meet a high mortality and to the complications of a lien system. In certain companies it may be largely due to the fact that deferred dividend policies are not now issued and accordingly the combination of a lien with a special dividend class is no longer possible.

There are several ways of measuring the extra mortality which can be borne by a lien. One of these methods "A" assumes that the same percentage of extra mortality is carried throughout the life of the policy—a condition which is seldom, if ever, met in practice. Another method "B" assumes that the extra mortality is a uniform percentage for a number of years, that it then disappears and that the lien continues during the period of extra mortality only. A third method "C" assumes that the extra mortality decreases with the duration of the policy and can be borne yearly by the lien until the lien is wiped out, and that thereafter the normal mortality is to be expected.

To avoid too many tables it seems advisable to limit the calculations in this paper to the three principal plans of insurance—namely, ordinary life, twenty-payment life, and twenty-year endowment. The results are submitted at decennial ages at issue from 20 to 60 inclusive, and for three tables of mortality, 150 per cent, 200 per cent, and 250 per cent of the normal mortality. The liens selected are $250, $500, and $750 per thousand, such liens decreasing (1) by the average premium charged for non-participating insurance, (2) by one-tenth of the lien annually, the initial reduction at the end of the first policy year. All the calculations in this paper are based on the American Men Select Table with interest at $3\frac{1}{2}$ per cent.

The method of calculating the extra mortality which the lien can carry under method "A" is described in my paper on "Practical Treatment of Underaverage Lives," *T.A.S.A.*, XVI, 64.

If we had a group where the extra mortality was expected to be the same percentage of the normal mortality during the life of the policy it is clear from the method "A" table that a heavy lien would be necessary to cover a comparatively light extra mortality.

As there are cases in which the extra mortality is expected to continue for several years only, and as some companies would like to cover the extra hazard by means of a lien, I am giving in the method "B" table the percentage of extra mortality which can

METHOD A

Additional Mortality Borne by Liens, on Assumption That Extra Mortality Continues during Life of Policy, Lien Reduced Annually by Annual Non-Participating Premium

Plan of Insurance	Lien per $1,000	Lien Reduced Annually by					Percentage of American Men Select Table Borne by Lien				
		Age at Issue					Age at Issue				
		20	30	40	50	60	20	30	40	50	60
Ordinary life................	$250	$16	$20	$27	$40	$65	5	4	3	2	2
Ordinary life................	500	16	20	27	40	65	23	18	16	14	11
Ordinary life................	750	16	20	27	40	65	85	75	64	52	41
Twenty-payment life.........	250	24	28	35	46	67	4	3	3	3	2
Twenty-payment life.........	500	24	28	35	46	67	18	15	15	15	13
Twenty-payment life.........	750	24	28	35	46	67	54	53	56	59	48
Twenty-year endowment......	250	42	43	45	52	70	7	6	4	3	2
Twenty-year endowment......	500	42	43	45	52	70	35	32	25	20	14
Twenty-year endowment......	750	42	43	45	52	70	151	133	109	78	51

METHOD B

Additional Mortality Borne by Liens, on Assumption That Extra Mortality Continues for Ten Years Only, Lien Reduced Annually by Amount Equal to One-Tenth of Lien, Reduction Commencing at End of First Year

Plan of Insurance	Lien per $1,000	Lien Reduced Annually by	Percentage of American Men Select Table Borne by Lien				
			Age at Issue				
			20	30	40	50	60
Ordinary life............	$250	$25	18	16	17	17	19
Ordinary life............	500	50	41	41	40	41	48
Ordinary life............	750	75	76	76	74	79	98
Twenty-payment life.....	250	25	18	18	17	18	20
Twenty-payment life.....	500	50	42	43	43	45	50
Twenty-payment life.....	750	75	83	83	81	88	105
Twenty-year endowment..	250	25	21	21	20	19	20
Twenty-year endowment..	500	50	53	53	49	48	52
Twenty-year endowment..	750	75	110	107	98	98	110

be borne on the assumption that such extra mortality continues as a uniform percentage for ten years only, and that the lien is reduced by one-tenth each year.

METHOD C

Lien Considered as Applicable to Extra Risk of Each Year
Lien Reducible Annually by Non-Participating Premiums

Policy Year	Age 20			Age 40			Age 60		
	Initial Amount of Lien			Initial Amount of Lien			Initial Amount of Lien		
	$250	$500	$750	$250	$500	$750	$250	$500	$750
	Ordinary Life								
	Percentage of American Men Select Table borne by lien								
1........	31	94	276	29	90	261	23	77	217
2........	28	89	261	25	83	243	14	62	179
3........	26	85	248	21	77	226	6	48	146
4........	24	81	236	18	71	210	......	36	119
5........	21	77	224	14	65	196	......	25	96
10........	11	58	177	......	38	136	......	......	16
15........	......	43	142	......	15	90	......	......	......
20........	......	29	114	......	......	50	......	......	......
25........	......	16	90	......	......	17	......	......	......
	Twenty-Payment Life								
1........	29	91	265	27	87	251	22	76	215
2........	26	85	248	23	79	231	14	61	178
3........	22	79	232	18	71	213	6	48	146
4........	19	73	217	14	64	196	......	35	119
5........	16	68	205	9	57	180	......	24	95
10........	......	44	151	......	25	116	......	......	14
15........	......	23	112	......	......	64	......	......	......
20........	......	3	80	......	......	15	......	......	......
	Twenty-Year Endowment								
1........	27	88	260	26	85	248	22	76	214
2........	21	79	240	20	76	226	13	60	175
3........	16	70	220	14	67	206	5	46	143
4........	10	62	203	9	58	188	......	33	115
5........	5	54	188	3	49	170	......	22	92
10........	......	15	121	......	9	97	......	......	9
15........	......	......	57	......	......	29	......	......	......

Under method "C" the extra risk of each year is assumed to be met by the lien against the policy, and accordingly the extra mortality thus carried would be a decreasing one. An interesting explanation of this method was given by Mr. J. K. Gore in 1915 (*T.A.S.A.*, XVI, 336). The extra mortality covered by the lien in each year is represented approximately by the ratio of the lien to the face amount of the policy less reserve and less lien. The reserves are on the preliminary term basis, Illinois Standard. The lien decreases annually by the non-participating premiums.

It will be noted that a substantial extra mortality is carried in the early policy years. This method is specially applicable to groups in which the extra mortality decreases steadily and finally disappears, and in determining the groups to which it is applicable the mortality by policy years should be analyzed. It is not so applicable to risks in which there is a high extra mortality for a few years, such as in applicants with a history of gastric ulcer, unless the lien is very substantial, is constant, and is eliminated within a comparatively short time. Nor are liens satisfactory in the case of an extra hazard which persists or tends to increase, such as marked overweight at the younger ages at entry, or a history of syphilis.

The lien system has the merit of creating a selection in favor of the company and of making the insurance easier to place among the better grade of impaired risks, i.e., those who have faith in their longevity, but objections are occasionally made that full protection is not given when most needed.

The question of the modification which should be made in cash paid-up and term extension values would involve an extended discussion, which is not feasible within the confines of this paper. Briefly, therefore, the problem is to determine an approximate method which will give justice to both the policyholders and the company under the different types of liens. It can readily be seen that the reserve is a different one under each lien, and that in order to obtain the theoretically correct reserve the expected mortality under each lien should be taken into account. An approximate method however is generally used, such as basing the reserve under method "A" on 150 per cent of the tabular mortality, with the lien applicable thereto, for all cases under which a mortality of from 130 per cent to 170 per cent is expected or basing the reserve on a lien of $300 per thousand, with the expected mortality applicable thereto, for all cases with liens of from $200 to $400. In determining the amount of paid-up insurance and the duration of the extended term insurance account should be taken of the expected mortality. Under method "B" the reserves in the early years would be higher than the normal but would be the same as the regular reserve after ten years.

Under the method "C" of considering the lien for each year as applicable solely to the additional risk of that year, Mr. John K. Gore considers that no change in the reserves or cash surrender values is required. The paid-up value, however, should have charged against it a proportionate part of the outstanding lien while the lien outstanding should be charged against the extended insurance.

Extra premiums.—As already intimated, the extra premium method may be used most successfully in the case of certain occupation hazards which are considered to be constant. It is also specially adapted to any other impairment in which the hazard is constant irrespective of age. In many companies the extra premium method is used for impairments which are represented by a uniform percentage of the tabular mortality and accordingly the exhibits submitted cover 150 per cent, 200 per per cent, and 250 per cent mortality as well as ten extra deaths per thousand per annum.

Before calculating the extra premiums it must be first determined whether these shall be participating or non-participating and whether any allowance should be made for additional surrender value. The general practice is to make such extra premiums non-participating, and not to grant additional surrender values. Under these conditions a loading of 10 per cent to 20 per cent for all expenses, including commissions, is customary. Our calculations have been based on the American Men Select Table with $3\frac{1}{2}$ per cent interest and *without* loading. These net extra premiums are assumed to continue (*a*) for the life of the policy, (*b*) for ten years.

Instead of charging an extra premium according to the expected additional mortality in each case, several companies have adopted the practice of using different sets of extra premiums, each of which applies to a group of policyholders with approximately the same expected mortality. For example, a set of *extra* premiums at 130 per cent mortality may be adopted for all persons rated from 125 per cent to 135 per cent inclusive and another set of *extra* premiums at 150 per cent for those whose expected mortality runs from 136 per cent to 164 per cent inclusive. The surrender values are the same as under corresponding policies without extra problem. Another method is to base the *scale* of premiums, reserves, and surrender values on multiples of the standard table—150 per cent, 200 per cent, and 250 per cent. The loading on the premiums may be determined by the same method as for standard risks.

When the surrender values are based on the higher rate of mortality expected, the general effect is to increase the cash values, except under endowment policy, to leave the paid-up values practically unchanged, and to decrease the duration of the term extension. When the cash values are left unchanged a common practice seems to be to grant the same paid-up values but to eliminate the term extension wherever a substantial extra premium is charged, thereby making paid-up insurance the automatic feature

AMERICAN MEN SELECT $3\frac{1}{2}$ PER CENT

NET EXTRA PREMIUMS PER $1,000 FOR ADDITIONAL MORTALITY

AGE AT ISSUE	+50 PER CENT	+100 PER CENT	+150 PER CENT	EXTRA DEATHS PER 1,000 PER ANNUM +10 DEATHS
		Ordinary Life		
20	$ 2.70	$ 5.20	$ 7.50	$ 8.00
30	3.50	6.70	9.50	7.60
40	5.30	9.90	14.20	7.30
50	8.70	16.50	23.70	7.20
60	15.30	29.10	41.90	7.10
		Twenty-Payment Life		
20	$ 3.40	$ 6.30	$ 9.00	$10.20
30	3.90	7.10	10.00	9.10
40	5.00	9.20	12.90	8.00
50	7.60	14.40	20.70	7.20
60	13.80	26.80	39.10	6.90
		Twenty-Year Endowment		
20	$ 1.20	$ 2.40	$ 3.60	$ 6.00
30	1.40	2.90	4.30	6.00
40	2.50	5.00	7.50	6.00
50	5.50	11.00	16.60	6.20
60	12.70	25.10	37.20	6.60

AMERICAN MEN SELECT 3½ PER. CENT—*Continued*

NET EXTRA PREMIUMS PAYABLE FOR TEN YEARS ONLY TO COVER EXTRA MORTALITY FOR TEN YEARS AND NORMAL THEREAFTER

Age at Issue	+50 Per Cent	+100 Per Cent	+150 Per Cent	Extra Deaths per 1,000 per Annum +10 Deaths
	Ordinary Life			
20	$ 1.80	$ 3.60	$ 5.50	$9.30
30	2.00	4.00	6.00	9.10
40	3.10	6.10	9.10	8.80
50	6.20	12.20	18.20	8.30
60	13.00	25.60	37.90	8.00
	Twenty-Payment Life			
20	$ 1.70	$ 3.50	$ 5.20	$8.90
30	1.90	3.80	5.70	8.70
40	2.90	5.80	8.60	8.40
50	5.80	11.60	17.30	8.10
60	12.50	24.80	36.70	7.80
	Twenty-Year Endowment			
20	$ 1.50	$ 3.00	$ 4.50	$7.80
30	1.70	3.40	5.10	7.80
40	2.60	5.30	7.90	7.70
50	5.50	11.00	16.40	7.70
60	12.30	24.30	36.00	7.70

in the policy. This is particularly desirable in the case of endowment insurances issued to highly impaired risks.

The simplicity of the extra premium method makes a strong appeal to many actuaries, especially if the extra premiums do not participate in surplus, the surrender values are not increased, and the additional reserve at the end of the calendar year is taken as one-half the net or gross premiums receivable.

Advance in age.—The method of advancing the age is used principally by companies issuing policies with annual dividends. There is a well-defined opinion that this form of meeting the extra mortality is more attractive to both the insured and the agent than the method of charging an extra premium, as dividends are usually paid on the basis of the advanced age of the insured and he is given the advantage of increased surrender values at the rated up age. On the other hand, it is contended that for companies issuing non-participating policies and for young companies which have a heavy lapse rate, the extra premium method is the more advantageous one.

Before calculating the advances in age which should be adopted it is necessary to determine the scale of commissions to be paid, and whether or not dividends are to be payable on the basis of the advanced age. The general custom is to treat the insured at his rated-up age exactly the same as an insured granted standard insurance at the corresponding true age. The advance in age, therefore, provides for the additional mortality expected, for commissions, dividends, and surrender values at the rated-up age. The method adopted by us to determine the advance in age is a simple one. We first calculate the net premium based upon the assumed mortality, 150 per cent, 175 per cent, 200 per cent, etc. This net premium is then compared with a set of net premiums based on the standard mortality table. The higher of the two ages at which the net premium on the standard table approximates to the net premiums on the assumed mortality is taken, and the difference between this age and the true age at entry is the advance in age. For example, the net premium at 150 per cent mortality for an ordinary life policy at age 30 is $18.15 and the corresponding net premium at 100 per cent mortality is $17.57 at age 35 and $18.27 at age 36. According to our rule therefore the advance in age would be six years. In the following tables examples have been given of the advance in age required in the case of 150 per cent, 200 per cent, and 250 per cent of the American Men Select Table, 3½ per cent and also in the case of a constant extra mortality of ten deaths per thousand annually.

The advance in age method in connection with occupation should be applied with judgment and discrimination. For the sake of simplicity some companies charge the same advance in age for all plans and for all ages at entry except at the older ages. This involves a knowledge of the average age at entry and of the popular plans of insurance. It may be well to mention that in probably the majority of hazardous occupations the average age is lower than in non-hazardous occupations. With regard to the older ages at entry it is not advisable in many of the hazardous occupations to charge an advance in age irrespective of the age of the applicant. One of the methods of limiting the charge is to provide that the increase in premium shall not be larger than that applicable to age 40 at entry.

AMERICAN MEN SELECT 3½ PER CENT

Advance in Age to Provide for Extra Mortality

Age at Issue	+50 Per Cent	+100 Per Cent	+150 Per Cent	Extra Deaths per 1,000 per Annum +10 Deaths
	Ordinary Life			
20	8	13	16	17
30	6	10	13	11
40	6	9	12	7
50	6	9	12	5
60	6	9	12	3
	Twenty-Payment Life			
20	8	14	17	19
30	7	11	14	13
40	6	9	12	8
50	5	9	12	5
60	5	9	12	3
	Twenty-Year Endowment			
20	15	20	23	27
30	8	13	15	18
40	6	9	12	11
50	5	9	12	6
60	5	9	12	3

In the advance in age method it should be clearly kept in mind that a proportion of the extra premium is returned on surrender in the case of life and limited payment life policies if the surrender value at the advanced age is granted.

Which is the best method for a company to adopt?—In deciding which method should be adopted by a company such considerations must be taken into account as the method of distributing dividends, if any, the conditions under which the company is doing business, the organization of the field force, the age and financial standing of the company and the experience of the officers. I question whether any actuary of experience is rash enough to select one method and state that it is best under all conditions. The fact is that each has advantages, and that each has disadvantages. It is a question of weighing these advantages and disadvantages and then determining which is best adapted to the conditions of the company. However much I might desire to help individual companies, it would be impossible to advise them of the best method to adopt, but I hope that my presentation will enable them to select the method best adapted to their needs.

HOW SHOULD POLICYHOLDERS WHO IMPROVE AS RISKS BE TREATED?

Before the liens, extra premiums, or advances in age are calculated the company should consider in a general way what its practice will be with regard to policyholders who improve as insurance risks. It may be necessary to provide an extra loading, or make a provision for extra mortality, if a very liberal course is adopted with regard to granting better terms after the policy is issued. There are two types which present themselves: (1) those who have changed from hazardous to non-hazardous occupations, (2) those whose physical condition has improved, or those who, for any other reason than change in occupation, improve as risks. With regard to the former, the general practice appears to be to eliminate the extra premium or advance in age, provided satisfactory evidence of insurability is obtained by the company. It is a good plan, in my judgment, to require a probationary period after the insured has changed his occupation. The lien system is not generally used in connection with hazardous occupations.

With regard to (2), the companies differ radically in their treatment, from the one extreme of refusing to make any concessions after the policy has been placed, to the other of granting better terms at any time in the future. If an insurance company were to grant the privilege of better terms with improved conditions and if, as a result, the agents made a practice of taking this matter up freely with the policyholders the group might have a higher mortality than was originally provided for. Such a practice would mean the elimination of the better risks from the group, leaving a deteriorated group of those whose condition had not improved or had become worse. While, theoretically, the company should not grant better terms to those who improve, as less liberal terms cannot be given to those who deteriorate, practically, modifications should be made, and it is only the extent of these which must be considered. It seems advisable for a young company to adopt a rule which will give each policyholder the advantage of his improved value as an insurance risk in the early policy years. It is best, however, to avoid too liberal a rule in the beginning, as it is much easier to liberalize than to restrict the period during which better terms may be made to the policyholders.

I should like to add one word to this part of the discussion with regard to a question which naturally arises. What allowance should be made at the time of change under a policy originally issued with an advance in age? If the policy has been long enough in force to acquire a cash value, an allowance is usually made to the insured of the difference between the cash value at the rated-up age at issue and at the original age at issue.

WHAT SHOULD BE THE MAXIMUM OF INSURANCE RETAINED ON EACH RISK?

It seems well to follow two maxims in determining the amount to be retained on each substandard risk: (*a*) the greater the risk the smaller should be the amount carried; (*b*) the more severe the possible selection against the company the smaller should be the company's limit. A schedule of the maximum amount to be taken on any individual risk should therefore be graded according to the two factors, age and degree of impairment, as the more highly rated the risk the greater is the selection likely to be. If I were to lay down a schedule for all ages at entry and for the various degrees of impairment, it would be easy to find fault with such a schedule. While it might appear satisfactory to a company with well-equipped medical and actuarial departments, the maximum amounts would be distinctly large for a young company or even for a well-established company without such advantages. Let me suggest therefore that it is wise to make the maximum amount for substandard risks not more on the average than one-half of the corresponding amount on standard risks, and that this method should be so applied that on the slightly impaired risks three-quarters, and on seriously impaired risks one-quarter of the maximum on standard risks would be taken. I am assuming that the maximum for standard risks depends on age and is less at the very young ages and at the older ages than at other ages. For example, it might be said that if a company were to take $25,000 on a first-class risk at age 40, it would place its maximum at $15,000 under cases with a mortality of 150 per cent, and not more than $10,000 under policies with an expected mortality of 200 per cent. (Such proportions would probably be too liberal if the maximum were $200,000.) If these substandard risks were aged 60, one-half of the amounts suggested would doubtless be a sufficient maximum.

SHOULD THE SAME SCALE OF COMMISSION BE ADOPTED FOR SUBSTANDARD AS FOR STANDARD BUSINESS?

A quarter of a century ago when a large company commenced to issue policies on the lien plan to substandard lives a lower commission was paid on such policies than under standard policies. This action may have been based on the desire to apply the savings in commission toward a mortality fluctuation fund and to discourage brokerage business. There was also evidently the feeling that the agents would be contented to receive a lower commission on business which had formerly been declined. This practice was continued for several years until it was apparent that the company was able to control the various factors connected with underaverage business. One of the considerations in deciding upon the change in payment of commissions under policies issued with lien, was the impression among the agents that in case of doubt the applicant would be given substandard insurance so as to save commission. There is no question that the agents will be more contented and will make a greater effort to place policies on substandard lives if the same scale of commission is allowed as on policies on standard lives. In my judgment, therefore, it is better to pay the regular scale of commission, whether the policy has been issued with lien, with an advance in age, or with an extra premium, excepting only policies under which a temporary extra premium has been charged. There are certain disadvantages to this rule, such as the loss to the company in connection with any refund of extra premiums paid, but in many cases an adjustment of commission can be made with the agent. While I have given my judgment on the basis of experience, I hesitate to give advice to the younger companies because there are considerations applicable to older companies operating in New York state which do not apply to the younger companies.

HOW SHOULD A COMPANY KEEP ITS RECORDS OF MORTALITY?

There is one requisite in connection with underaverage business, namely, the ability of the actuary to determine from time to time whether or not the underaverage buisness is carrying itself. Such business should not be done if it is a detriment to the policyholders under standard policies; but, on the other hand, the substandard policyholders in a mutual company should not be discriminated against in favor of the standard policyholders. The ideal way is to so treat the substandard policyholders that they will be on a par individually, as far as may be, with standard policyholders.

In order that mortality investigations may be made, a card, handwritten or perforated, should be prepared for each underaverage case placed on the books of the company. Our practice is to prepare a typewritten card when the policy is issued from the home office, and three months later to prepare a perforated card. This avoids preparing perforated cards on substandard cases not placed, but involves calling for the application papers from the files in order to place the medical information on the perforated cards, which is not done when the typewritten card is prepared. We have found that it is better to prepare interim cards, when the policies are issued, rather than to wait for a suitable time to write cards containing complete data after the policies have been paid for.

The perforated cards should be made in duplicate, one set being kept in numerical order, and the other in mortality investigation order. The latter may be divided into suitable groups. An investigation should be made periodically to determine the relationship between the actual and the expected mortality. For several years it may be necessary to use this guide alone, but at a later date different groups should be investigated, such as those rated up for occupation, for habits, for heart murmurs, for albuminuria, etc., to determine whether these groups are being treated justly. In the meantime the papers in connection with death losses occurring in the early policy years should be carefully studied as errors in the future may thereby be avoided.

The investigation into the mortality on substandard risks involves special problems which can only be indicated here, such as the treatment of cases with two or more impairments, and the possible combination of groups with different incidence of mortality. Furthermore, the company may base its provision for extra mortality on the assumption that it will be constant over a period of years; whereas in the majority of impairments there is a decreasing mortality relative to the normal. Under such conditions the extra mortality may be higher than the expected, but not higher than that provided for over a series of years. For example, an extra premium may be charged to provide in a certain group for 50 per cent extra mortality, but the mortality to be expected in that group may run from 70 per cent in the early policy years to 35 per cent in the later policy years. It would be incorrect to assume that the company was losing money if the relative mortality were above 50 per cent in the early policy years. While this may not appear a matter of moment, it has caused some concern in the minds of those who have not fully realized the stiuation.

DISABILITY AND DOUBLE INDEMNITY BENEFITS

In view of the large number of companies which are granting disability and double indemnity benefits in connection with life insurance policies, a brief statement seems desirable with regard to the limitation of these benefits to underaverage lives.

There are certain types of applicants to whom disability benefits are not usually granted, such as underweight persons at the young ages with tubercular family history, persons with a history of blood-spitting or of syphilis, and those with a strong family record of insanity. It is not customary to issue disability benefits to applicants who have lost an arm, a leg, or an eye; nor to those in occupations involving considerable hazard of loss of limb from accident, or marked liability to tuberculosis. On the other hand, there are certain types of moderately impaired risks to whom disability benefits might be issued at a proper rate, such as persons with certain forms of heart murmur, and those with intermittent albuminuria.

With regard to double indemnity, the principal hazard to be guarded against is increased liability to accident which particularly comes from occupation and from physical inability to take care of one's self quickly in a moment of danger such as would result from the loss of a leg or from deafness.

CONCLUSION

After having presented a paper a few years ago on the treatment of underaverage lives, and after the extended discussion of it by several prominent actuaries, I am conscious that very little new material appears, or could appear in the present paper. I trust, however, that the tables and the brief statement of the problems will be of value to the officers of the younger companies. In this connection, I wish to thank Mr. Graham and his associates for their active co-operation in the preparation of the preliminary tables.

While my views have changed in certain details with increasing experience and with knowledge obtained from other actuaries, my opinions regarding the main principles of writing underaverage business have remained unchanged. As there is no system of treating underaverage lives which is satisfactory in every respect I believe that a method should be adopted which gives substantial justice to all the policyholders, that such method should be adapted to the conditions under which the company does business, that the method should be simple in operation at the home office, that it should be readily understood by the policyholders, and, that finally, its salability and appeal to the agents should always be kept in mind.

DISCUSSION OF TWO PRECEDING PAPERS

C. H. Beckett: Mr. Hunter has limited his paper in scope to eight topics under the general subject of "Underaverage Business with Special Reference to the Problems of a Young Company," and this discussion will be accordingly limited.

Before consideration is given to these topics I wish to make a more general observation which is so obviously in order that it calls for no explanation.

It is recorded that upon one occasion when Senator Roscoe Conkling was addressing the United States Senate upon a great question of constitutional law he was observed to be directing all of his remarks to Senator Allen G. Thurman. Finally, Senator Thurman became annoyed and asked, "Why, may I inquire, does the Senator address himself to me personally?"

Senator Conkling replied in effect: "When the pious Jew would offer his adoration to Jehovah, he instinctively turns to Jerusalem; when the devout Mohammedan is called to prayers he turns to Mecca; and so when I discuss a question of constitutional law I turn to the distinguished Senator from Ohio."

We shall not address our brief discussion to Mr. Hunter, but we recognize him as our foremost student of the subject of insuring underaverage lives. Whatever he says upon this subject is always heard with the respect that is associated with his unusual attainments, and whenever this question is discussed he is referred to and quoted more than any other man.

Since many of the companies which are represented in this Institute are earnestly struggling with some of the problems connected with the insurance of underaverage lives, the suggestions of Mr. Hunter, I apprehend, will be carefully considered, and reference to his paper will frequently be made.

If it were possible, I should be glad to emphasize the conditions set out as being essential before a young company should insure lives known to be underaverage. Of course, the author covers the entire subject when he states that the affirmative answer to the question, "Should a young company insure underaverage lives?" depends upon the ability of the officers to handle the problems connected therewith.

Since in any individual case the officers are likely to be the judges of their own qualifications and might possibly be prejudiced in favor of themselves, it is well that they are asked to pass the test as to whether they have sufficient knowledge to correctly use all available information. To set up artificial standards of measurements for such tests would be useless as well as ridiculous, but I think it would be difficult to overstate the necessity of very searching preliminary preparations by those having in charge the selection of a company's risks before they embark on any plans for accepting substandard insurance.

If attempts are made to rate business and issue substandard policies before a correct program, which can be adherred to, is completely formulated, it will place a handicap upon future development in so far as agency problems are involved, and in addition contribute to a general discrediting of substandard practice.

Oftentimes a frank statement of the experience and practice of an individual company is helpful to others that either have not entered this field or are less advanced in their experience than the reporting company.

Although the Medical and Actuarial departments of the State Life had worked together closely for many years, we felt that when we approached the numerical rating plan we should have a sort of underwriting committee, and such a committee, made up of the medical director, actuary, and one experienced underwriter was appointed.

After we had gathered together all available statistics and reached definite conclusions as to our ideals, we began rating all applications received and then discussed these ratings and their results at regular sessions of the committee, held four times each week. In the course of our studies we prepared a card system of something over a thousand occupational ratings and a large number of physical ratings, these cards showing the ratings of the companies who were experienced in writing substandard business. Finally from all of the data available we built up our system, but applied it only to acceptances for standard insurance or rejections for a period of about two years before we felt satisfied to issue policies on lives which we considered ineligible for insurance on regular forms at standard rates. It is my own conviction that no less amount of intensive study upon the part of those long experienced in the insurance of standard lives would fit them for the vastly more complicated work of making a start in selecting lives of various degrees of departure from standard, and then offering them suitable plans of insurance.

Supplementing the author's comments relating to sources of necessary information, I would suggest that since the problem is a development in thought and practice, and therefore evolutionary in character, most of the papers and discussions should be studied critically, and much of the literature upon the subject is of value only as showing the development of ideas. This fact, however, should not deter anyone from thoroughly familiarizing himself with the development of the thought in reference thereto. Personally, I think this is essential, for the practical man must know why and in what respects ideas once held and now discarded have not proved to be sound. He must also be on his guard constantly if dealing with statistical data or published experience, so as to be certain that the basis of the figures before him is practically analogous to the elements of the problem which he is endeavoring to solve, and that the results are expressed in terms of tables which he proposes to employ.

There are so many published papers upon the subject of methods of meeting the expected extra mortality that any extended discussion of this topic could be nothing other than a repetition of what has already been clearly presented. In addition to papers printed in the proceedings of actuarial societies I wish to call attention to the very excellent paper printed in the *Proceeding of the Medical Section of the American Life Convention*, March, 1922, and prepared by Mr. George Graham. The portion of this paper which deals with premium charge and form of contract is particularly effective. The fact that this paper was not read before a society of actuaries will justify my departure in directing the attention of members of the profession to it at this time.

It was somewhat of a surprise that Mr. Hunter should devote so much attention to a discussion of the lien system. However, I think that this course is highly commendable. It is my impression that there have been more self-deceptions in the employment of this method than any other, save possibly the use of endowment forms, and such a table as "Method A" will certainly have a marked deterrent effect upon anyone who may be tempted to use a lien to cover a substantial extra mortality for a group in which the extra mortality is likely to continue during the life of the policy.

Table "C" is of considerable interest, particularly in connection with the assumption that the lien plan is applicable to groups of decreasing extra risks. The percentages given are merely the ratios of the net lien to the net claim.

This unusually full presentation of the lien system will serve to clarify the subject, but any personal enthusiasm for the lien system which I might have is always suppressed by the thought that its employment too frequently deprives the insured of protection which he needs, and which oftentimes could be safely granted by other methods.

In connection with the advance-in-age method, I wish to call attention again to a situation which should never be ignored. If such method is used, and surrender values granted corresponding to the advanced age, the extra mortality provided for is usually slight during the early policy years as compared with the later, and it is unsound to assume that if an extra mortality, of say 50 per cent, should be expected for a considerable period that the early deficiency would be made up by the later excesses. We have in this connection to consider those who lapse and those who surrender. The latter class, besides failing to contribute its share to the excess cost, withdraws a substantial part of the assumed extra premium as a cash value.

As a further caution against the use of the rated-up-age method by young companies I wish to call your attention to Mr. Henry Moir's conclusion that much of the extra mortality in underaverage classes is at young ages and early years of insurance. Since in such events the financial effect is much heavier than if the extra were spread evenly over the duration of the table, therefore the young and developing company would sustain its greatest losses at a time when it could least afford to meet them.

The tables based on the American Men Select Table are very interesting. One of the troublesome problems in this whole matter has always been to interpret M.A. ratings in terms of American Experience, and the new tables based upon American Men Select will assist materially in this interpolation.

No actuary would state that any one method is best for all cases or even for any one company. In fact, I think that no company should attempt to select underaverage lives and grant policies to them unless, and until, it is so thoroughly familiar with all methods that it knows quite definitely just what each method accomplishes, but I most firmly believe that the extra-premium method, based upon extra percentages of mortality with non-forfeiture values following the assumption as to expected mortality, will more adequately meet the conditions that prevail in many important types of risks which come within the experience of the average small company than any other single plan.

The matter of removal of extra ratings is well stated in principle. In practice such a course must be followed as will best meet whatever situation arises, keeping in mind at all times the danger of leaving as substandard only decidedly deteriorated groups. Again I wish to depart by directing attention to a very complete and satisfactory discussion of this subject by Mr. T. A. Phillips, American Life Convention Medical Section, March, 1921.

As would be expected of such an investigator with mortality experience as Mr. Hunter, he advises that young companies make their plans to keep a record of substandard business so as to be able to determine the results of their selections. It impresses me that this is too important to ever ignore. In the first place, a company will desire to know whether it has been successful in predetermining the probable mortality and has been charging various types of risks such premiums as result in substantial equity among all policyholders. Even further than this, since any additional reliable data which will be secured as a guide to future selections must come from the experience with selections made on present information, each company will wish to add the results of its experience to that of all the others. In this way real progress will be made in the business of insuring lives, if such degree of uniformity as regards nomenclature and general underwriting practice can be attained and practiced by various companies as will permit such a joint investigation of the result of selections to be made on a basis sufficiently uniform and consistent as to be substantially reliable.

Mr. Hunter concludes that there is no system of treating under-average lives which is satisfactory in every respect, and to this statement every honest and intelligent student of the subject will agree, but more insurance officials are earnestly studying the subject than ever before, and out of this continual digging, pondering, investigating, and counseling, good will come to all concerned, and the business of insuring lives is thereby making progress.

Mr. T. A. Phillips: I was very glad to hear Mr. Beckett's introductory remarks and believe they were happily placed at the opening of this discussion, because this is a subject on which we are bound to find differences in opinions and perhaps differences which appear to be sharp. On this subject, however, we do not have the same groundwork from which to proceed as we have in the case of our ordinary business, and if that is kept in mind and the expressions of the different writers and speakers are carefully studied, I think we will find they are often not so far apart as they appear to be on the surface.

What few remarks I have to make will be confined principally to a consideration of the suitability—or unsuitability—of certain tables as a base from which to calculate extra premiums, although without any attempt of course to cover the entire subject. The thoughts which occurred to me were suggested by the following paragraph in Mr. Mead's paper: "Speaking of basing the extra premiums for substandard risks upon the American Men Table, that is, the extra premiums obtained by comparing standard premiums according to the American Men Table with the premiums resulting from those based upon percentage additions to the mortality of the American Men Table, it is not quite clear to the writer why the same relative margins should not be applied for substandard risks as standard risks, or, rather, why smaller relative margins should be ventured for substandard than for standard risks."

It seems to me this does not take into account one distinction which must be made at the outset, namely, whether the extra premiums are to be participating or non-participating. Perhaps I can best illustrate what I have in mind by approaching the proposition from the point of view of a participating company. It may be taken for granted, I think, that such a company has no object in securing an overcharge in its premiums except up to the usual amounts deemed necessary for sake of safety. Perhaps also you will pardon the statement that to some extent, at least, the premiums which can be charged by non-participating companies are influenced by the net cost of the mutual or participating company. We would seem, therefore, to be on safe ground in approaching the proposition from the point of view of the latter company, and in making later any further deductions or changes needed to suit the particular problems of the non-participating company.

To simplify the proposition as far as possible, let us assume the case of a participating company which is doing only a standard business and which has the advantage of a table prepared from its own experience, reflecting accurately its own mortality rates. It is required by law to maintain its policy reserves and base its surrender values on the American Table with the result that it will likely calculate its gross premiums from the American Table. It is true the premiums need not necessarily be calculated from the American Table, but from whatever basis they are prepared, the gross premium must be such that it is not less than the net premium on the American Table, which is the valuation net premium. We are dealing with a practical matter here, however, and as in everyday business the most of such companies calculate their gross premiums from the American Table, I am proceeding from that hypothesis. The company's own basic mortality experience is of course different from the mortality shown by the American Table, being in all probability much lower at certain ages, although perhaps the equal at some few points. This difference, however, is equalized in so far as the policyholder is concerned, by means of his policy dividends, i.e., in that portion of the dividends which is due to mortality margins.

Assume further that such a company proposes to do a substandard or extra premium business. One of the first propositions which it will have to face will be the question as to whether it may be required by law or by insurance department rulings to maintain its substandard reserves upon some stated basis, differing from the basis prescribed for standard lives. Upon this question would depend to a very great extent the answer to any question as to how the gross premiums for the substandard business were to be calculated. There are of course no legal provisions for valuation of reserves on such business other than very general ones to the effect that the Commissioner of Insurance may fix special or impaired tables upon which reserves are to be maintained for impaired lives accepted. There is a very general feeling among insurance departments that the reserves on substandard business must necessarily be higher than those for standard business. The general desire of actuaries to put as a first consideration the safety and welfare of their companies leads them in the same direction. Thus we note an increasing tendency during the last few years on the part of both the companies and the insurance departments to base reserves for substandard business on a table or tables representing multiples of the mortality shown by the American Table. Personally I have felt that there is a very strong likelihood as substandard business becomes more commonly done over the country, that insurance departments will prescribe impaired tables for the valuation of substandard reserves and that most probably the basis upon which this will finally settle will be a multiple or multiples of the American Table mortality—so long at least as the American Table remains the standard for valuation of reserves on standard lives. Such an argument or theory would appear to lead quite naturally to the conclusion that the extra premiums for substandard business should be derived by taking the differences between premiums corresponding to multiples of the American mortality and premiums for the American Table itself. The case is not completed, however, by the foregoing statement, as there are other considerations which must be taken into account. The only conclusion which is warranted up to this point would be that the extra premiums, however they may be calculated, ought to be such that when added to the normal premiums for standard lives, the results would not be less than the net premiums on the valuation basis which is likely to be prescribed. When the further question of distribution of annual dividends is considered, it is likely that the company in the illustration given may find itself in an uncomfortable position if it calculates its extra premiums on the basis of percentage additions to the American Table mortality with a loading corresponding to the loading given on its ordinary premiums for standard business. It would immediately be brought up against the problem of a special dividend distribution or a series of distributions for its substandard class or classes, which distribution would have to be made annually. Such a distribution might be carried out in either of two ways: First, by actually ascertaining the mortality in each special class and annually distributing mortality profits with relation to the difference between the experienced mortality and the multiple of the American mortality on which its premiums were based. This, I think, will be dismissed by most of us as impracticable. Second, by carrying through its initial assumption that in that class of substandard business, for example, which was accepted at premiums representing 150 per cent of the American Table, it anticipates a mortality of 150 per cent of its standard or basic mortality and therefore is justified in distributing to this particular class mortality profits proportionate to the difference between 150 per cent of the American mortality and 150 per cent of its basic or standard mortality. If the theories underlying the second method are to be followed, however, the same or at least substantially equivalent results can be reached and a great amount of clerical work and calculation can be avoided by charging for the particular case a special premium made up as follows: First, the company's normal or standard rate for a standard life, plus, second, an extra premium corresponding to the difference between the net premium for 150 per cent of the company's basic or standard experience and that for 100 per cent of its basic experience, this extra carrying sufficient loading merely to cover such additional expenses as are incurred or paid on the extra premium (with at some points a possible further adjustment so that the total would not be less than required valuation net premium), and thereafter when computing dividends for such a policy, allow the same mortality profit as is allowed on a corresponding policy at standard rates. While it is somewhat apart from the subject I am discussing, it might be good policy to allow exactly the same amount of dividend each year to such a case as is allowed to a corresponding standard policy. The portions of dividend from loading as well as from mortality would be the same on the hypothesis stated, the only point of difference being in the interest profit where the substandard reserve is greater than the reserve on the similar standard policy. The practice would be justifiable, I believe, at least until such time as the company could positively demonstrate the accuracy of its ratings and corresponding extra premium rates.

The foregoing argument seems to point clearly to the desirability of such a company calculating its extra premiums from percentage additions to its own basic or standard mortality experience, principally as a matter of expediency and office convenience in the saving of routine and clerical calculations, and other work. It is just as logical a method of making the computations, and I believe equally as justifiable as others from any theoretical or scientific standards which can be applied under present-day conditions and our present limited knowledge of substandard business. In the absence of a special table representing the individual company's own standard mortality experience, the use of the American Men Table for American companies, I believe, is fully justified.

Passing now to the case of non-participating companies, I must confess I can see little difference between them and the participating companies with respect to this one question, i.e., the basis from which extra premiums are to be calculated. It is a fact that many non-participating companies calculate their gross premiums for their standard business from a table representing their own mortality experience or from the American Men Table using an amount of loading which they deem appropriate, taking into consideration their own circumstances or needs, and bearing in mind also the fact that the American Table is the basis for reserve valuations. It is but a step farther in the same direction for the non-participating company to derive its extra premiums for substandard business from percentage additions to its own standard experience, or from percentage additions to the American Men Table, using again whatever loading is deemed necessary or appropriate in the case of that particular company, and also keeping in mind the net premium which may be required for reserve valuations on the substandard class.

It is quite possible to lay too much emphasis on this phase of the substandard business, i.e., the basis for calculation of the extra premiums. Personally I am not so much interested in the question of rates as I am in the question of ratings. It is apparent of course that in the foregoing I have had in mind only the numerical system of rating substandard cases. The numerical system in accepting a case at a mortality rating of plus 50 assumes that a mortality is anticipated of 150 per cent of something. It seems to me that if there is any sensible, logical or well-founded basis for a company's acceptance of such a case, that "something" must be the company's own standard mortality experience or some other experience which is close enough to its own to make a satisfactory and safe standard by which to measure. That company which has done an extensive business, both standard and substandard, has the advantage of knowing definitely the mortality which its underwriting practices produce on standard business and knowing further that in certain types of impairments it can select risks which will show fairly definitely established extra mortality percentages over that shown on its standard business and can charge premiums to correspond. The company, on the other hand, which has not had such a large experience of its own and wishes to enter the substandard field, must judge of the mortality it expects to have on substandard classes by means of such experiences as the Medico-Actuarial investigations and the published experiences of a few companies which have been pioneers in the substandard field and have been so liberal as to make public their own experiences, notably, such companies as the New York Life Insurance Company, and it is appropriate at this point to state that the life insurance world owes a very deep debt of gratitude to that company. In making deductions from such experiences, however, the company which is lacking in its own experience must have sufficient medical and actuarial training and intelligence to be able to translate the published experiences into terms of mortality ratios corresponding to the basic or normal mortality which it is attempting to obtain on its standard business, and in addition it must also have a fairly accurate conception of the underwriting principles which were followed in the selection of the business from which the mortality ratios it follows are derived. This again illustrates the statement that it is not so much the rates as the ratings in which we should be concerned.

In conclusion it is a pleasure to express a very hearty compliment to Mr. Mead upon the complete and instructive paper which he has presented.

MR. F. S. WITHINGTON: I want first to express appreciation of both Mr. Hunter's and Mr. Mead's most comprehensive and admirable papers. Of course, it would be impossible to make extended comment on every feature of these papers. I have merely made a few notes on what it seems to me are the most important features and those most far-reaching in their effect.

It has always appeared to me that in handling substandard risks we should never lose sight of the necessity, or, what seems to me the necessity of securing the same margin of gains from mortality in substandard, that is, the same relative margin, at least, as for standard risks. I must express disagreement with that portion of Mr. Hunter's paper wherein he suggests the use of the American Men Table as a basis for calculating net premiums and reserves.

The American Men Table was compiled—this has always been my understanding—primarily for one purpose and that was to find a measure of the actual mortality in American companies on insured men's lives as a test of the American Experience Table, and on comparison, on an ultimate basis, it was found that, on the average, the American Experience Table, while slightly deficient at the older ages, was an eminently safe standard on which to calculate premiums, reserves, and surrender value equities, as it supplies a margin of gain in mortality at the younger and middle ages which seems ample to cover most contingencies. I do not wish to be understood as making any attempt to discredit, either more or less, the American Men Table. It is valuable in determining dividends and in adjusting loadings on premiums, but I believe it to be impracticable to use it as a basis for the calculation of net premiums or reserves. The American Men Table might be used, as is the Medico-Actuarial Table, for the purpose of determining the class in which a substandard risk belongs, but after such a risk is so classified, the net premiums and reserves for it should be based on the American Experience Table. If we need, for standard lives, the larger margin of gain in mortality afforded by that table, there will certainly be a much greater need for it in the case of substandard lives.

Regarding the question of reserves on substandard business, I see no reason, if we base our premiums on multiples of the American Experience Table (which basis I strongly favor), why we should depart from recognized methods of computing these reserves on standard policies, when we need reserves on similar substandard policies. I think we can preserve the equities as between policyholders and policy forms in this way just as effectively as we can for standard policies.

I also believe that surrender values should be based upon the reserves which are the mathematical equivalents of net premiums computed by the multiple extra premium method based on the American Experience Table.

I want to express absolute agreement with Mr. Mead in his contentions regarding the proper method of computing substandard net premiums and reserves.

Now, in the matter of dividends, the relation between participating and non-participating policy contracts, as far as substandard business is concerned, should be, I think, just the same relation as obtains now in the matter of standard policies. In other words, I believe that the difference between participating and non-participating policies should be considered to be a matter of loading. The question of distributing dividends must be, I think, largely a matter of judgment of the individual company and the individual actuary, just as it is at present.

I do not believe in depending upon dividends alone to equalize or compensate for extra mortality created by the issuance of substandard business. I do not think that is sound practice. It has been suggested to me that the net premiums according to the American Men Table could be used and then an extra loading provided to take care of the extra mortality. I think that is mere guesswork. Why should we depart from recognized methods in this matter? I think it would be an entire mistake—a great mistake. I think we are introducing unnecessary complications by suggesting the use of the American Men Table for these purposes.

Another thing, I think that we would introduce additional complications by making too many special tables based on special curves in mortality. I agree with Mr. Mead in that also, that a table constructed on multiples of the American Men Table, with a constant percentage, if you please, of the q_x column will cover most cases of physical impairment. Of course, it won't cover accidental hazards but it will, I believe, cover the great majority of substandard business.

Now, the question has been brought up as to the acceptance of reserves on substandard business where the same are lower than on standard policies, and whether such reserves would be or could be accepted by insurance commissioners in various states or not. The reserves on substandard cases, on ordinary life policies, are invariably larger, on the multiple method which I have suggested, than on standard cases, and as far as I have been able to ascertain, as yet, the reserves on limited payment life policies will always be larger on that same basis, because the net single premium for the life policies at the attained age at the end of the premium payment period is always larger than the standard net single premium, so that it is fair to assume without special calculation that the intervening reserves will always be larger.

In nearly all cases of endowment policies, however, the total reserve on these policies is smaller than that on similar policies on standard lives. I think the reason for this will be obvious to most of us but perhaps it might be well to suggest an illustration of this.

Suppose we separate the reserve on a substandard endowment policy into its own two elements of pure endowment and term insurance; we will find that the reserve on the pure endowment portion will be materially less than the reserve on standard policies on a similar form, and growing less, of course, with the increase in degree of impairment. On the countrary, we will find the term portion of the reserve to be materially greater on the substandard policy than on the standard form.

Now, there would be no question in any mind, I think, if this policy were issued in two contracts, as to the sufficiency and adequacy of the reserves on either. Why should there be any question as to the sufficiency of the reserve or the legality of the reserve on the accepted standard or legal standard, if these two contracts are brought together in one contract, even though the total reserve is shown to be less than that on a standard policy.

I can see no reason why that should not be acceptable, either to insurance departments or to others.

Mr. Beckett: May I interrupt the discussion to make a statement? I did not understand that I was to discuss other than Mr. Hunter's paper. Therefore, my remarks are confined to Mr. Hunter's paper. I read Mr. Mead's paper with a great deal of interest but I did not prepare myself to discuss it owing to a misunderstanding that I was to discuss Mr. Hunter's paper alone.

R. G. Hunter: We are certainly indebted to Mr. Mead for giving us a comprehensive study of the history and principles of substandard insurance. It has been quite difficult, at least I have found it so, to trace the evolution of substandard insurance, and I am glad that Mr. Mead has had the time and the patience to piece it together from the fragments that have appeared in the various actuarial publications.

In tracing the history of substandard insurance, Mr. Mead leaves the reader with the impression that Great Britain played little part in the development of the actuarial principles of substandard insurance. While it is true that the British actuaries have contributed little information regarding the mortality among impaired risks, I believe it is far from true that they did not comprehend the true principles of substandard insurance. The literature on this subject appearing in England is as illuminating for me as the literature appearing in the United States.

In recounting the history of substandard insurance in the United States, Mr. Mead has stated that the New York Life decided to adopt the rated-up age method as a practical solution of granting substandard insurance. As a matter of fact, the New York Life adopted the lien method combined with a special dividend class and used this method until the New York insurance laws prohibited the issuance of deferred dividend policies. Then it adopted the rated-up system. Mr. Mead also states that this method followed the English methods, the reserves and surrender values being based on the rated-up age. The English method does not require that surrender values be based on the rated-up age. In Mr. Lutt's paper, to which Mr. Mead refers, it is shown that out of twenty-six companies who value the policies on the basis of the rated-up age, only ten grant surrender values at the rated-up age and three allow the mean between the rated-up age and true age value.

I am unable to follow Mr. Mead's reasoning in respect to the lien method. Few, if any, will take exception to his statement that "what applicants for insurance require is protection and this is not accomplished adequately by means of the lien." But if that is true of cases that require a moderate lien, it seems to me to apply as forcibly, if not more so, to risks that require a heavy lien. To grant an applicant an endowment policy with a lien of $800 is certainly not giving him what he needs.

The table of Mr. Arthur Hunter's appearing in Mr. Mead's paper showing the percentages of mortality borne by liens of $300, $500, and $700 brings home to us the small percentage of extra mortality that can be borne by good-sized liens. It gives, however, a wrong impression of the adaptability of the lien method in cases where the mortality is a decreasing one, such as in the case of tubercular family histories. Mr. Hunter's table is based upon a constant mortality lasting throughout the life of the policy. If he had used a decreasing extra mortality vanishing at age 40 or 45, the percentage of mortality that would be borne by the liens would be found to be considerably greater.

In describing the advance in age method, Mr. Mead has condemned it in no uncertain tones. If the advocates of the advance in age method are in error by assuming that the rated-up age mortality will be experienced on substandard lives as a group, I think that Mr. Mead falls into almost as bad an error by assuming that the mortality will be a constant percentage of the normal mortality. We know very little of the incidence of substandard mortality. There is a well-grounded impression that the mortality on substandard cases as a group begins slightly above the normal, increases to a maximum, and then decreases, thereafter approaching the standard mortality table at the older ages. The statistics, however, upon which this impression has been formed are somewhat meagre, and I believe that we will have to wait for some years before we can determine satisfactorily the incidence of substandard mortality. Recently Mr. Hoskins in his paper to the Actuarial Society presented a table based upon the Medico-Actuarial Investigation showing that the mortality curve that we might expect from substandard cases as a group would produce reserves not unlike the rated-up age reserves. Be that as it may, I am unable to see the force of Mr. Mead's objection to the rated-up method in that the extra mortality borne by the rated-up method in the first year is only 9 per cent, whereas under the percentage mortality method, it is 150 per cent. The company is not going to suffer financially by reason of the mortality curve being different, so long as the extra premium is sufficient, except when the matter of surrender value arises. In that case, of course, there is a loss to the company that uses the rated-up method unless such loss is taken care of by a larger extra premium. Mr. Mead's illustration, however, would lead us to assume that the loss to the company using the rated-up age method is very great, and he himself comes to this conclusion when he says that "it is realized in what a hazardous position a company is placing itself by using the advance in age method unless it is extremely well entrenched financially." If the rated-up method is so unsound as to entail considerable loss to the company using it, I am unable to see how it becomes less so by reason of the company being well entrenched financially.

H. G. SELLMAN: Mr. Hunter, in his article on "Underaverage Business with Special Reference to the Problems of a Young Company," states that the officers of a company which has been in existence for a few years would be well advised to confine the writing of business to standard lives and in the meantime to collect all possible information regarding substandard risks. The executive of a young company, who has the vision necessary to establish that company as a great financial institution within the span of a single life, is apt to be impatient with such advice. I would recommend to such an executive that, instead of waiting for the accumulation of the necessary statistics from his own experience, he enter at once upon the writing of substandard business on the statistics which Mr. Hunter has so abundantly furnished from time to time. A young company is under the mighty necessity of getting a volume of business sufficient to carry the necessary overhead expense and also the necessity of developing an agency organization. The necessity of volume to a young company may result in the offering to such a company of more than the ordinary amount of substandard business. To give the service which is mandatory, and still to safeguard the ultimate solvency of the institution, a substandard business is almost a necessity. The dangers of a rule of "standard business only" may be greater than the practice of rating risks. With the volume of statistics which are now available, and with the study which actuaries have recently made along the lines of substandard business, this kind of insurance may now be considered a part of the normal function of a life insurance company and not a special branch of the business which may or may not be undertaken. A young company entering the field of life insurance should, it seems to me, as a part of the regular business, endeavor to rate the applications submitted to it in accordance with the best information which is available. Assuming that this is the intention of the company, a plan of operation may be developed naturally as the business of the young company grows. The first pressure on the company for the acceptance of business is in connection with under-weight and over-weight cases and occupational ratings. The offering of modified policies to meet the requirements in these respects will be a great protection to the young company over the practice of accepting as standard or absolutely declining cases. If the officers in charge of selecting the business avail themselves of the data which can now be secured, and if they will make a conscientious effort to apply the available statistics to each case, they may reasonably anticipate that their substandard business will prove satisfactory.

In the first place the conception of zoning of the risks, as described by Mr. Beckett in his paper presented to the American Life Convention in October, 1921, is necessary. In that paper Mr. Beckett gives a picture of strips or zones running out from a certain vertical line. The line represents the mortality base. The base which would probably be assumed by the majority of actuaries today would be the American Men Table; that is, an ultimate mortality based on the American Men Table could be taken as the standard, and all cases accepted as standard would have to fall within the zone of which that line is the center. Substandard business would be beyond that zone. On the basis of the calculations which appear elsewhere in this number of the *Record*, zones of 150 per cent, 200 per cent, and 250 per cent of that table may be established.

In selection as to height and weight, "The Standard Mortality Ratios Incident to Variations to Height and Weight among Men," as reported by the joint Committee of the Actuarial Society and Association of Actuaries and Medical Directors, may be taken as a basis. In applying the extra ratings based on the American Men Table, it must be remembered that the mortality ratios stated therein are based on the Medico-Actuarial Table. In getting a ratio to be applied on the American Men extras, it will be necessary to adjust the ratio before applying the extra premiums. A comparison at ten-year age intervals of the ultimate rates of mortality on the two tables is given under Table I hereafter referred to.

As a guide to the rating of occupations, Mr. Hunter and Dr. Rogers have given in No. 63 of the *Transactions of the Actuarial Society* the basis upon which a schedule of occupational ratings may be established. While specific extra premiums are not given therein, the relative value of an insurance risk on account of the occupational hazard is given. Its use as a guide in the selection of life insurance risks is invaluable. In the preparation of occupational ratings special consideration is required as to the nature of the hazard. The risk may be chiefly from accident, or it may be due to a general lowering of vitality as a result of unhealthy conditions which are inherent in the work and consequently unavoidable.

A rating of medical impairments need not be undertaken until the office has become thoroughly familiar with general underwriting practice. Then, as occasion may demand, ratings may be made in cases which are covered in the *Transactions of the Actuarial Society* or in the *Record of the American Institute.*

We will have available with the forthcoming issue of the *Record* a basis for calculating extra ratings on the American Men Table of Mortality. In Table I herewith is given a comparison of the death rate per thousand on the American Experience Table of Mortality, the Medico-Actuarial Table, and the Standard American Men Ultimate Table, with the various extra mortality rates based on the American Men Table. The comparison is made at ten-year intervals for ages 20 to 60. In Table II is shown a comparison of the death-rate per thousand, substituting the American Men Select Table. In the selection of risks the ultimate percentage should be borne in mind instead of the select, although the premium rates, which have been computed are on the basis of select tables.

Table III brings together the calculations made on the American Men Table for the ordinary life plan showing net premium as follows: (1) American Experience Table, (2) on the American Men Select Standard Table, (3) the American Men Select 150 per cent, (4) net extra 150 per cent, (5) American Men Select 200 per cent, (6) net extra 200 per cent, (7) American Men Select 250 per cent,

(8) net extra 250 per cent, (9) American Men Select with ten extra deaths per thousand, (10) the net extra for ten per thousand additional deaths, (11) American Men Select 20 additional deaths per thousand, (12) net extra for 20 additional deaths per thousand.

TABLE I

COMPARISON OF THE DEATH-RATE PER THOUSAND ON THE AMERICAN EXPERIENCE TABLE, THE MEDICO-ACTUARIAL, AND THE STANDARD AMERICAN MEN TABLE (ULTIMATE), WITH VARIOUS EXTRA MORTALITY RATES BASED ON THE AMERICAN MEN TABLE

Interest 3½ Per Cent

AGE	AMERICAN EXPERIENCE MORTALITY RATE PER 1,000	MEDICO-ACTUARIAL	AMERICAN MEN—ULTIMATE					
			Standard	150 Per Cent	200 Per Cent	250 Per Cent	10 Extra Deaths a 1,000	20 Extra Deaths a 1,000
20.......	7.805	....	3.92	5.880	7.81	9.80	13.92	23.92
30.......	8.427	4.9	4.46	6.690	8.92	11.15	14.46	24.46
40.......	9.794	5.7	5.84	8.760	11.68	14.60	15.84	25.84
50.......	13.781	10.6	11.58	17.370	23.16	28.95	21.58	31.58
60.......	26.693	24.0	26.68	40.020	53.36	66.70	36.68	46.68

TABLE II

COMPARISON OF THE DEATH-RATE PER THOUSAND ON THE AMERICAN EXPERIENCE TABLE OF MORTALITY AND THE STANDARD AMERICAN MEN TABLE (SELECT) WITH VARIOUS EXTRA MORTALITY RATES BASED ON THE AMERICAN MEN TABLE

Interest 3½ Per Cent

AGE	AMERICAN EXPERIENCE MORTALITY RATE PER 1,000	AMERICAN MEN—SELECT					
		Standard	150 Per Cent	200 Per Cent	250 Per Cent	10 Extra Deaths a 1,000	20 Extra Deaths a 1,000
20........	7.805	2.73	4.095	5.46	6.83	12.73	22.73
30........	8.427	3.01	4.515	6.02	7.53	13.01	23.01
40........	9.794	3.71	5.565	7.42	9.28	13.71	23.71
50........	13.781	6.78	10.170	13.56	16.95	16.78	26.78
60........	26.693	14.92	22.380	29.84	37.30	24.92	34.92

The foregoing plan contemplates the use of extra premiums only, in which event standard policy values at the true age would be used. In general the extended insurance would be eliminated. The inclu-

TABLE III

COMPARISON OF NET ORDINARY LIFE PREMIUMS ON THE AMERICAN EXPERIENCE TABLE AND THE AMERICAN MEN (SELECT) TABLE WITH MORTALITY RATINGS BASED ON THE AMERICAN MEN (SELECT) TABLES

Interest $3\frac{1}{2}$ Per Cent

AGE	AMERICAN EXPERIENCE	AMERICAN MEN—SELECT										
		Standard	150 Per Cent	Net Extra 150 Per Cent	200 Per Cent	Net Extra 200 Per Cent	250 Per Cent	Net Extra 250 Per Cent	10 per 1,000 Extra	Net Extra	20 per 1,000 Extra	Net Extra
20	13.48	10.72	13.36	2.64	15.81	5.09	18.10	7.38	18.59	7.87	26.96	16.24
30	17.19	14.74	18.15	3.41	21.28	6.54	24.16	9.42	22.23	7.49	30.24	15.50
40	23.50	21.75	26.77	5.02	31.41	9.66	35.61	13.91	28.84	7.09	36.52	14.77
50	34.99	34.15	42.14	7.99	49.90	15.75	57.05	22.90	40.58	6.43	48.03	13.88
60	56.83	56.23	69.21	12.98	83.00	26.77	95.81	39.58	61.01	4.78	68.35	12.12

sion or exclusion of the disability and additional accident indemnity benefits would require special consideration. For the writing of substandard insurance, policy forms on the ordinary life, twenty-payment life, and endownment plans providing paid-up insurance as the automatic feature, would be required.

The use of the lien policy is limited, and the young company may not find it necessary to undertake the issuing of such forms.

The feeling has been expressed this morning that the American Men Impaired Lives Table should not be used as the basis of extra premium. However, it seems to me that as that is the basis assumed as representing the normal experience of these companies it might very well be taken as the basis for computing the extra premiums for additional mortality.

J. G. PARKER: Mr. Mead in this paper has given such a complete review of the history of substandard insurance and of the principles underlying it, that it is very difficult to add anything to the subject by means of a discussion.

In the part of the paper referring to the classification and rating of risks, Mr. Mead states that it seems absolutely necessary that each individual company work out by evolutionary methods its own plan for substandard insurance. I believe that it is quite possible also for a group of companies to work out a satisfactory system of underwriting substandard insurance. The work done by the Committee of the American Life Convention, and also the work done by a committee of medical directors and actuaries under the direction of the Life Officers' Association of Canada, is proof that great progress can be made by co-operation between different companies.

Under the same caption he goes on to outline the composition of an underwriting board. In addition to a representative from the Medical Staff, the Actuarial Staff, and the Executive, some companies have included a representative of the Field Staff. The inclusion of this last representative has advantages and disadvantages. The advantages are that this representative has a personal knowledge of practically every agent in the company's service, and his opinion as to the selection which might have been exercised by the particular agent is of great value. He also has a personal acquaintance with the different examiners in the field and a knowledge of their local reputation for ability and character, which is of great help to the Committee. I cannot help but feel, however, that there is a tendency in every medical committee, even though there is not a field representative among the members, to err on the side of leniency, and undoubtedly the majority of field representatives will argue for an increase in this leniency rather than otherwise.

On my return from an agency trip I know that I always have a whole notebook full of reasons why we should be able to accept men for standard insurance who had been rated up prior to my leaving the head office. I must confess that in many cases my opinion is very easily biased in favor of a risk written by a man who is a personal friend of mine as against a risk offered, let us say, in the way of reassurance. I feel also that in a great many medical committees the judgment on the company's own risks is less severe than the judgment on a case offered to the company in the way of reassurance. I think that it is the opinion of practically all of my friends in the medical committees of the various companies with whom we do business that this is due to the influence toward leniency which the regard for the field staff of the company inspires in the members of a medical committee.

I cannot entirely agree with Mr. Mead that it is a safe method to give the assured the option of taking a liened policy or a rated-up policy. It may be that my opinion is based on prejudice, not on facts. I am under the impression that Mr. Arthur Hunter before the Actuarial Society gave the experience of his company, and that this experience was decidedly against the practice of allowing the assured any such option.

It is true, however, that the assured in the great majority of cases would be influenced in his selection by the salesman. Our company, along with several other Canadian companies, has had under consideration the doing away with the lien system and using entirely a rating-up system. In a trip throughout our various branches in the month of April I broached the subject to our agency force and I found a great diversity of opinion. Some were very positive that it was much easier to place a rated-up policy than a liened contract, while other branches had equally strong but opposite opinions. It might, therefore, be held that the selection of an option varies not so much according to the nature of the risk but according to the opinions held by the salesman who is placing the contract.

It was interesting to note that a majority of our men favored a system of rating up in age rather than a system of liens. The attitude of the agent is important in that if we can properly sell our agency force on the equity of our methods in doing substandard business we will be much more successful in placing a large number of substandard cases.

Mr. Mead quotes a table from Mr. Arthur Hunter's paper showing the amount of mortality borne by various liens on the basis of the American Table of mortality with 3½ per cent interest. I have had on my medical files for some years a table prepared by Mr. W. A. P. Wood, actuary of the Canada Life, showing the liens corresponding to a rating up in age of 3 years, 5 years and 7 years, the basis of conversion being the H^m Table of Mortality with 3½ per cent interest. With Mr. Wood's permission I have attached the table to this discussion.

WHOLE LIFE POLICIES

INITIAL LIEN AND ANNUAL DECREASE PER $1,000

Equivalent to a Loading of Three Years in Age

H^m 3½ Per Cent

AGE AT ENTRY	LEVEL FOR 1 YEAR RUNNING OFF IN			LEVEL FOR 5 YEARS RUNNING OFF IN				LEVEL FOR 10 YEARS RUNNING OFF IN		
	10 Years	15 Years	20 Years	1 Year	5 Years	10 Years	15 Years	1 Year	5 Years	10 Years
20.	$688	$486	$379	$748	$544	$410	$332	$388	$329	$278
	69	32	19	748	109	41	22	388	66	28
25.	769	540	420	832	605	455	368	431	364	307
	77	36	21	832	121	45	25	431	73	31
30.	774	543	420	841	608	458	368	434	367	307
	77	36	21	841	122	46	25	434	73	31
35.	791	548	419	861	624	463	367	441	368	304
	79	37	21	861	125	46	24	441	74	30
40.	799	546	413	883	627	460	361	437	363	298
	80	36	21	883	125	46	24	437	73	30
45.	745	507	382	822	586	428	335	408	337	276
	74	34	19	822	117	43	22	408	67	28
50.	674	456	345	748	529	384	302	365	301	249
	67	30	17	748	106	38	20	365	60	25
55.	581	400	308	644	455	336	269	318	266	223
	58	27	15	644	91	34	18	318	53	22
60.	486	343	272	527	382	287	236	272	230	198
	49	23	14	527	76	29	16	272	46	20

WHOLE LIFE POLICIES

Initial Lien and Annual Decrease per $1,000
Equivalent to a Loading of Five Years in Age
H^m $3\frac{1}{2}$ Per Cent

Age at Entry	Level for 1 Year Running Off in			Level for 5 Years Running Off in				Level for 10 Years Running Off in		
	10 Years	15 Years	20 Years	1 Year	5 Years	10 Years	15 Years	1 Year	5 Years	10 Years
20	$1,155	$810	$630	$1,258	$909	$683	$551	$647	$547	$461
	116	54	32	1,258	182	68	37	647	109	46
25	1,231	866	673	1,338	971	730	589	691	585	493
	123	58	34	1,338	194	73	59	691	117	49
30	1,247	873	671	1,347	980	736	588	702	590	490
	125	58	34	1,347	196	74	39	702	118	49
35	1,262	868	659	1,391	995	732	578	695	579	478
	126	58	33	1,391	199	73	39	695	116	48
40	1,237	845	638	1,361	971	712	558	678	562	461
	124	56	32	1,361	194	71	37	678	112	46
45	1,134	769	579	1,257	891	648	507	618	509	417
	113	51	29	1,257	178	65	34	618	102	42
50	1,003	682	520	1,115	787	573	454	543	451	374
	100	45	26	1,115	157	57	30	543	90	37
55	851	591	461	934	667	497	401	470	396	334
	85	39	23	934	133	50	27	470	79	33
60	706	502	405	767	556	422	352	396	340	298
	71	33	20	767	111	42	23	396	68	30

WHOLE LIFE POLICIES

INITIAL LIEN AND ANNUAL DECREASE PER $1,000
Equivalent to a Loading of Seven Years in Age
H^m $3\frac{1}{2}$ Per Cent

AGE AT ENTRY	LEVEL FOR 1 YEAR RUNNING OFF IN			LEVEL FOR 5 YEARS RUNNING OFF IN				LEVEL FOR 10 YEARS RUNNING OFF IN		
	10 Years	15 Years	20 Years	1 Year	5 Years	10 Years	15 Years	1 Year	5 Years	10 Years
20.......	$1,590	$1,116	$869	$1,723	$1,250	$935	$760	$892	$752	$635
	159	74	43	1,723	250	94	51	892	150	63
25.......	1,665	1,171	906	1,814	1,310	986	794	934	791	663
	167	78	45	1,814	262	99	53	934	158	66
30.......	1,682	1,170	896	1,821	1,327	989	786	943	788	655
	168	78	45	1,821	265	99	52	943	158	66
35.......	1,679	1,149	869	1,859	1,319	967	761	919	764	628
	168	77	43	1,859	264	97	51	919	153	63
40.......	1,595	1,088	820	1,757	1,254	918	718	874	723	592
	159	73	41	1,757	251	92	48	874	145	59
45.......	1,440	975	736	1,599	1,131	820	643	781	644	529
	144	65	37	1,599	226	82	43	781	129	53
50.......	1,245	853	655	1,382	976	716	571	677	566	473
	124	57	33	1,382	195	72	38	677	113	47
55.......	1,046	732	578	1,137	821	615	507	583	492	421
	105	49	29	1,137	164	62	34	583	98	42
60.......	862	623	512	934	677	522	444	488	425	379
	86	42	26	934	135	52	30	488	85	38

The figures in the table are further proof of the fact that very rarely do we put on our policies liens sufficient to cover the extra mortality which we might expect the risks to show.

Mr. Mead refers to the difficulty encountered in case of the assured selecting paid-up endowment insurance where there is a lien against the policy. Such difficulty does not exist in Canada as we are allowed to state right in our policy that the same percentage of lien will apply to the paid-up insurance as applied before the policy became paid up.

In spite of the weight of evidence brought forward by Mr. Mead against the rating-up-in-age method of doing substandard business I still favor it as against either the lien system or the system of extra premiums based on percentage additions to the standard mortality table. Without entering too deeply into the argument I would think that the advantages of the rating-up in age method are:

1. The ease of explaining the method to the field force.

2. The method renders it easy for the agent to place the policy, thus insuring a more uniform group and further insuring a greater probability of absence of selection against the company in the group of substandard lives.

3. This method renders it more easy to make an adjustment of the rating up, should such adjustment prove necessary in later years owing to the improvement of the risk.

To compensate for the fact that the dividends and the surrender values are higher in the rating-up-in-age method we collect a higher premium from the assured. This is a very great advantage, particularly in the case where an improvement in the risk renders an adjustment necessary. I think it also important to state that I know of no experience which would lead one to believe that there will be more surrenders among rated-up policies than any other class of insurance; in fact I believe that the higher dividends credited to rated-up policies will have a big effect in retaining the business on the books of the company.

Referring to this matter of an adjustment in the rating up in event of there being an improvement in the risk I know that it is the practice of several American companies to make this adjustment. It has not been the practice of our company to make any adjustment, except in the case of liened contracts, where an adjustment is readily made because of the fact that the extra premium for the risk is obtained from those risks which fall in by death. We have not experienced very much difficulty in persuading our agents, and consequently the assured, of the equity of the position which we take in these cases demanding readjustment. Popular demand and competition may force us to alter our practice in this regard, but in such event I feel that it will be very necessary to secure a greater initial rating.

During the course of this year the Committee of Medical Directors and Actuaries of Canadian companies working on the subject of substandard insurance were faced with the problem of finding a basis for the conversion of percentage of extra mortality into years rating up. Mr. V. R. Smith, the actuary of the Confederation Life, and myself were assigned the duties of making a comparison of ratings according to different tables of mortality. A comparison of the number of years addition to the age according to the various tables is of great interest, and I append a table (see page 232) showing this comparison.

The figures show a considerable decrease in the number of years rating corresponding to a given percentage if either the American Men or the Canadian Men Table is used, as compared with either the $O^m(5)$ or the H^m table.

In the working out of the figures in the above table according to the American Men Ultimate Table and the Canadian Men Ultimate Table, there were prepared in the Actuarial Departments of the Confederation Life and the Imperial Life the fundamental values for the calculation of premiums on the Ordinary Life plan. In the galley proof submitted to the members of the Institute there is included the fundamental values, American Men $3\frac{1}{2}$ per cent select. I am submitting herewith certain of the values according to the Canadian Men $3\frac{1}{2}$ per cent ultimate table. These may be published in this discussion or separately, or not at all, according to the wishes of the editor of the *Record*.

COMPARISON OF RATINGS

Age	Percentage	Percentage of Mortality				
		125	150	175	200	250
20	$O^m(5), 3\frac{1}{2}$	5	10	13	16	....
	$H^m, 3\frac{1}{2}$	5	9	13	15	....
	$C^m(5), 3\frac{1}{2}$	4	8	11	13	....
	$A^m(5), 3$	4	7	10	12	16
25	$O^m(5), 3\frac{1}{2}$	5	8	12	14	....
	$H^m, 3\frac{1}{2}$	5	8	11	14	....
	$C^m(5), 3\frac{1}{2}$	4	7	9	11	14
	$A^m(5), 3$	4	7	9	11	14
30	$O^m(5), 3\frac{1}{2}$	4	8	10	13	....
	$H^m, 3\frac{1}{2}$	4	8	11	13	....
	$C^m(5), 3\frac{1}{2}$	3	6	8	10	13
	$A^m(5), 3$	3	6	8	10	13
35	$O^m(5), 3\frac{1}{2}$	4	7	9	12	....
	$H^m, 3\frac{1}{2}$	4	7	10	12	....
	$C^m(5), 3\frac{1}{2}$	3	5	7	9	11
	$A^m(5), 3$	3	5	7	9	12
40	$O^m(5), 3\frac{1}{2}$	4	6	9	11	....
	$H^m, 3\frac{1}{2}$	4	6	9	11	....
	$C^m(5), 3\frac{1}{2}$	3	5	7	8	11
	$A^m(5), 3$	3	5	7	9	11
45	$O^m(5), 3\frac{1}{2}$	3	6	8	10	....
	$H^m, 3\frac{1}{2}$	3	6	8	10	....
	$C^m(5), 3\frac{1}{2}$	3	5	7	8	11
	$A^m(5), 3$	3	5	7	8	11
50	$O^m(5), 3\frac{1}{2}$	3	6	8	10	....
	$H^m, 3\frac{1}{2}$	3	6	8	9	....
	$C^m(5), 3\frac{1}{2}$	3	5	6	8	11
	$A^m(5), 3$	3	5	7	8	11
55	$O^m(5), 3\frac{1}{2}$	3	5	7	9	....
	$H^m, 3\frac{1}{2}$	3	5	7	9	....
	$C^m(5), 3\frac{1}{2}$	3	5	6	8	10
	$A^m(5), 3$	3	5	7	8	11
60	$O^m(5), 3\frac{1}{2}$	3	5	7	9	....
	$H^m, 3\frac{1}{2}$	3	5	7	9	....
	$C^m(5), 3\frac{1}{2}$	3	5	6	8	10
	$A^m(5), 3$	3	5	7	9	11

IMPAIRED LIFE TABLES

$q'_x = 150$ Per Cent q_x

$C^m(5)$ $3\frac{1}{2}$ Per Cent

Age	q'_x	l_x	D_x	N_x
15	.00515	100,000	59,689	1,321,737.65
16	.00534	99,485	57,374	1,262,048.65
17	.00555	98,954	55,137	1,204,674.65
18	.00575	98,405	52,977	1,149,537.65
19	.00596	97,839	50,892	1,096,560.65
20	.00618	97,256	48,878	1,045,668.65
21	.00635	96,655	46,933	996,790.65
22	.00648	96,041	45,058	949,857.65
23	.00656	95,419	43,252	904,799.65
24	.00660	94,793	41,516	861,547.65
25	.00660	94,167	39,847	820,031.65
26	.00659	93,545	38,245	780,184.65
27	.00654	92,929	36,708	741,939.65
28	.00648	92,321	35,234	705,231.65
29	.00645	91,723	33,823	669,997.65
30	.00642	91,131	32,468	636,174.65
31	.00638	90,546	31,169	603,706.65
32	.00639	89,968	29,922	572,537.65
33	.00644	89,393	28,726	542,615.65
34	.00653	88,817	27,576	513,889.65
35	.00668	88,237	26,469	486,313.65
36	.00686	87,648	25,403	459,844.65
37	.00710	87,047	24,376	434,441.65
38	.00735	86,429	23,384	410,065.65
39	.00767	85,794	22,427	386,681.65
40	.00800	85,136	21,503	364,254.65
41	.00837	84,455	20,610	342,751.65
42	.00881	83,748	19,746	322,141.65
43	.00930	83,010	18,911	302,395.65
44	.00986	82,238	18,101	283,484.65
45	.01047	81,427	17,316	265,383.65
46	.01118	80,574	16,556	248,067.65
47	.01194	79,673	15,817	231,511.65
48	.01281	78,722	15,100	215,694.65
49	.01376	77,714	14,402	200,594.65
50	.01481	76,645	13,723	186,192.65
51	.01599	75,510	13,063	172,469.65
52	.01730	74,303	12,420	159,406.65
53	.01874	73,018	11,792	146,986.65
54	.02031	71,650	11,180	135,194.65
55	.02207	70,195	10,583	124,014.65
56	.02399	68,646	9,999.0	113,431.65
57	.02612	66,999	9,428.8	103,432.65
58	.02846	65,249	8,872.6	94,003.85
59	.03104	63,392	8,328.4	85,131.25

IMPAIRED LIFE TABLES

$q'_x = 150$ Per Cent q_x

$C^m(5)$ $3\frac{1}{2}$ Per Cent

Age	q'_x	l_x	D_x	N_x
60	.03387	61,424	7,796.5	76,802.85
61	.03696	59,344	7,277.9	69,006.35
62	.04038	57,151	6,771.8	61,728.45
63	.04413	54,843	6,279.0	54,956.65
64	.04826	52,423	5,799.0	48,677.65
65	.05277	49,893	5,332.6	42,878.66
66	.05771	47,260	4,880.1	37,546.05
67	.06312	44,533	4,443.1	32,665.95
68	.06905	41,722	4,022.0	28,222.85
69	.07553	38,841	3,617.7	24,200.85
70	.08261	35,907	3,231.3	20,583.15
71	.09036	32,941	2,863.9	17,351.85
72	.09881	29,964	2,517.0	14,487.95
73	.10802	27,003	2,191.6	11,970.95
74	.11805	24,086	1,888.8	9,779.35
75	.12902	21,243	1,609.6	7,890.55
76	.14093	18,502	1,354.3	6,280.95
77	.15389	15,895	1,124.3	4,926.65
78	.16800	13,449	919.1	3,802.35
79	.18324	11,190	738.9	2,883.25
80	.19983	9,140	583.0	2,144.35
81	.21776	7,314	450.8	1,561.35
82	.23715	5,721	340.7	1,110.55
83	.25815	4,364	251.1	769.85
84	.28061	3,237	179.9	518.75
85	.30491	2,329	125.1	338.85
86	.33107	1,619	84.0	213.75
87	.35913	1,083	54.3	129.75
88	.38907	694	33.6	75.45
89	.42095	424	19.8	41.85
90	.45504	246	11.1	22.05
91	.49088	134	5.9	10.95
92	.52907	68	2.9	5.05
93	.56811	32	1.3	2.15
94	.61085	14	.55	.85
95	.65244	5	.20	.30
96	.70145	2	.10	.10
97	.75000	1		
98	.81081			

IMPAIRED LIFE TABLES

$q'_x = 175$ Per Cent q_x

$C^m(5)$ $3\frac{1}{2}$ Per Cent

Age	q'_x	l_x	D_x	N_x
15	.00600	100,000	59,689	1,289,631.74
16	.00623	99,400	57,325	1,229,942.74
17	.00648	98,781	55,041	1,172,617.74
18	.00670	98,141	52,835	1,117,576.74
19	.00695	97,483	50,707	1,064,741.74
20	.00721	96,805	48,651	1,014,034.74
21	.00740	96,107	46,667	965,383.74
22	.00756	95,396	44,755	918,716.74
23	.00765	94,675	42,915	873,961.74
24	.00770	93,951	41,147	831,046.74
25	.00770	93,228	39,449	789,899.74
26	.00768	92,510	37,822	750,450.74
27	.00763	91,800	36,262	712,628.74
28	.00756	91,100	34,768	676,366.74
29	.00753	90,411	33,339	641,598.74
30	.00749	89,730	31,969	608,259.74
31	.00744	89,058	30,656	576,290.74
32	.00746	88,395	29,399	545,634.74
33	.00751	87,736	28,193	516,235.74
34	.00761	87,077	27,036	488,042.74
35	.00779	86,414	25,922	461,006.74
36	.00800	85,741	24,850	435,084.74
37	.00828	85,055	23,818	410,234.74
38	.00858	84,351	22,822	386,416.74
39	.00894	83,627	21,861	363,594.74
40	.00933	82,879	20,933	341,733.74
41	.00977	82,106	20,036	320,800.74
42	.01027	81,304	19,170	300,764.74
43	.01085	80,469	18,332	281,594.74
44	.01150	79,596	17,519	263,262.74
45	.01222	77,681	16,732	245,743.74
46	.01304	77,720	15,969	229,011.74
47	.01393	76,707	15,228	213,042.74
48	.01495	75,638	14,508	197,814.74
49	.01605	74,507	13,308	183,306.74
50	.01727	73,311	13,126	169,498.74
51	.01866	72,045	12,464	156,372.74
52	.02018	70,701	11,818	143,908.74
53	.02186	69,274	11,188	132,090.74
54	.02370	67,760	10,573	120,902.74
55	.02574	66,154	9,973.4	110,329.74
56	.02798	64,451	9,387.9	100,356.34
57	.03047	62,648	8,816.5	90,968.44
58	.03320	60,739	8,259.3	82,151.94
59	.03621	58,722	7,714.9	73,892.64

IMPAIRED LIFE TABLES

$q'_x = 175$ Per Cent q_x

$C^m(5)$ $3\frac{1}{2}$ Per Cent

Age	q'_x	l_x	D_x	N_x
60	.03952	56,596	7,183.7	66,177.74
61	.04312	54,359	6,666.6	58,994.04
62	.04711	52,015	6,163.3	52,327.44
63	.05149	49,565	5,674.7	46,164.14
64	.05630	47,013	5,200.6	40,489.44
65	.06157	44,366	4,741.8	35,288.84
66	.06732	41,634	4,299.1	30,547.04
67	.07364	38,831	3,874.2	26,247.94
68	.08055	35,971	3,467.6	22,373.74
69	.08811	33,074	3,080.5	18,906.14
70	.09637	30,160	2,714.1	15,825.64
71	.10542	27,253	2,369.4	13,111.54
72	.11527	24,380	2,047.9	10,742.14
73	.12602	21,570	1,750.6	8,694.24
74	.13773	18,852	1,478.4	6,943.64
75	.15052	16,256	1,231.7	5,465.24
76	.16441	13,809	1,010.8	4,233.54
77	.17953	11,539	816.15	3,222.74
78	.19600	9,467	647.0	2,406.59
79	.21378	7,611	502.6	1,759.59
80	.23314	5,984	381.7	1,256.99
81	.25405	4,589	282.9	875.29
82	.27668	3,423	203.8	592.39
83	.30118	2,476	142.5	388.59
84	.32737	1,730	96.17	246.09
85	.35572	1,164	62.52	149.92
86	.38624	750	38.9	87.4
87	.41899	460	23.1	48.5
88	.45392	267	12.9	25.4
89	.49110	146	6.8	12.5
90	.53088	74	3.3	5.7
91	.57269	35	1.5	2.4
92	.61724	15	.6	.9
93	.66280	6	.2	.3
94	.71265	2	.1	.1
95	.76118	1	....	....
96	.81835	....	....	....

IMPAIRED LIFE TABLES

$q'_x = 200$ Per Cent q_x

$C^m(5)$ $3\frac{1}{2}$ Per Cent

Age	q'_x	l_x	D_x	N_x
15	.00686	100,000	59,689.06	1,259,970.97
16	.00712	99,314	57,274.97	1,200,281.91
17	.00740	98,607	54,944.19	1,143,006.94
18	.00766	97,877	52,693.17	1,088,062.75
19	.00794	97,127	50,521.16	1,035,369.58
20	.00824	96,356	48,425.24	984,848.42
21	.00846	95,562	46,402.13	936,423.18
22	.00864	94,754	44,453.90	890,021.05
23	.00874	93,935	42,579.39	845,567.15
24	.00880	93,114	40,779.94	802,987.76
25	.00880	92,295	39,054.35	762,207.82
26	.00878	91,483	37,401.70	723,153.47
27	.00872	90,680	35,819.71	685,751.77
28	.00864	89,889	34,306.53	649,932.06
29	.00860	89,112	32,859.89	615,625.53
30	.00856	88,346	31,475.77	582,765.64
31	.00850	87,590	30,151.13	551,289.87
32	.00852	86,845	28,883.75	521,138.74
33	.00858	86,105	27,669.21	492,254.99
34	.00870	85,366	26,504.10	464,585.78
35	.00890	84,623	25,384.94	438,081.68
36	.00914	83,870	24,308.27	412,696.74
37	.00946	83,103	23,271.47	388,388.47
38	.00980	82,317	22,271.85	365,117.00
39	.01022	81,510	21,307.73	342,845.15
40	.01066	80,677	20,376.79	321,537.42
41	.01116	79,817	19,477.85	301,160.63
42	.01174	78,926	18,609.10	281,682.78
43	.01240	77,999	17,768.63	263,073.68
44	.01314	77,032	16,954.92	245,305.05
45	.01396	76,020	16,166.36	228,350.13
46	.01490	74,959	15,401.67	212,183.77
47	.01592	73,842	14,659.09	196,782.10
48	.01708	72,666	13,937.81	182,123.01
49	.01834	71,425	13,236.50	168,185.20
50	.01974	70,115	12,554.33	154,948.70
51	.02132	68,731	11,890.36	142,394.37
52	.02306	67,266	11,243.39	130,504.01
53	.02498	65,715	10,612.70	119,260.62
54	.02708	64,073	9,997.609	108,647.923
55	.02942	62,338	9,397.961	98,650.314
56	.03198	60,504	8,813.015	89,252.353
57	.03482	58,569	8,242.669	80,439.338
58	.03794	56,530	7,686.678	72,196.669
59	.04138	54,385	7,144.938	64,509.991

IMPAIRED LIFE TABLES

q'_x = 200 Per Cent q_x

$C^m(5)$ $3\frac{1}{2}$ Per Cent

Age	q'_x	l_x	D_x	N_x
60	.04516	52,135	6,617.720	57,365.053
61	.04928	49,781	6,105.233	50,747.333
62	.05384	47,328	5,608.109	44,642.100
63	.05884	44,780	5,126.749	39,033.991
64	.06434	42,145	4,661.91	33,907.242
65	.07036	39,433	4,214.413	29,245.332
66	.07694	36,658	3,785.347	25,030.919
67	.08416	33,838	3,375.991	21,245.572
68	.09206	30,990	2,987.293	17,869.581
69	.10070	28,137	2,620.557	14,882.288
70	.11014	25,304	2,277.009	12,261.731
71	.12048	22,517	1,957.698	9,984.722
72	.13174	19,804	1,663.595	8,027.024
73	.14402	17,195	1,395.586	6,363.429
74	.15740	14,719	1,154.230	4,967.843
75	.17202	12,402	939.648	3,813.613
76	.18790	10,269	751.729	2,873.965
77	.20518	8,339	589.803	2,122.236
78	.22400	6,628	452.934	1,532.433
79	.24432	5,143	339.570	1,079.499
80	.26644	3,886	247.899	739.929
81	.29034	2,851	175.723	492.030
82	.31620	2,023	120.472	316.307
83	.34420	1,383	79.574	195.835
84	.37414	907	50.422	116.261
85	.40654	568	30.508	65.839
86	.44142	337	17.489	35.331
87	.47884	188	9.426	17.842
88	.51876	98	4.748	8.416
89	.56126	47	2.200	3.668
90	.60672	21	.950	1.468
91	.65450	8	.350	.518
92	.70542	3	.127	.168
93	.75748	1	.041	.041
94	.81446	....	....	....
95	.86992	....	....	....
96	.93526	....	....	....
97	1.00000	....	....	....

IMPAIRED LIFE TABLES

$q'_x = 250$ Per Cent q_x

$C^m(5)$ 3½ Per Cent

Age	q'_x	l_x	D_x	N_x
15	.00858	100,000	59,689.06	1,206,425.0523
16	.00890	99,142	57,175.78	1,146,735.9923
17	.00925	98,260	54,750.84	1,089,560.2123
18	.00958	97,351	52,410.00	1,034,809.3723
19	.00993	96,418	50,152.37	982,399.3723
20	.01030	95,461	47,975.44	932,247.0023
21	.01058	94,478	45,875.77	884,271.5623
22	.01080	93,478	43,855.26	838,395.7923
23	.01093	92,468	41,914.42	794,540.5323
24	.01100	91,457	40,054.25	752,626.1123
25	.01100	90,451	38,274.07	712,571.8623
26	.01098	89,456	36,572.98	674,297.7923
27	.01090	88,474	34,948.31	637,724.8123
28	.01080	87,510	33,398.57	602,776.5023
29	.01075	86,565	31,920.68	569,377.9323
30	.01070	85,634	30,509.55	537,457.2523
31	.01063	84,718	29,162.51	506,947.7023
32	.01065	83,817	27,876.67	477,785.1923
33	.01073	82,924	26,647.02	449,908.5223
34	.01088	82,034	25,469.59	423,261.5023
35	.01113	81,114	24,340.42	397,791.9123
36	.01143	80,238	23,255.60	373,451.4923
37	.01183	79,321	22,212.39	350,195.8923
38	.01225	78,383	21,207.46	327,983.5023
39	.01278	77,423	20,239.34	306,776.0423
40	.01333	76,434	19,305.12	286,536.7023
41	.01395	75,415	18,403.63	267,231.5823
42	.01468	74,363	17,533.24	248,827.9523
43	.01550	73,271	16,691.57	231,294.7123
44	.01643	72,135	15,877.08	214,603.1423
45	.01745	70,950	15,088.17	198,726.0623
46	.01863	69,712	14,323.58	183,637.8923
47	.01990	68,413	13,581.33	169,314.3123
48	.02135	67,052	12,861.01	155,732.9823
49	.02293	65,620	12,160.72	142,871.9723
50	.02468	64,115	11,480.01	130,711.2523
51	.02665	62,533	10,818.11	119,231.2423
52	.02883	60,866	10,173.64	108,413.1323
53	.03123	59,111	9,546.183	98,239.4923
54	.03385	57,265	8,935.325	88,693.3093
55	.03678	55,327	8,340.996	79,757.9843
56	.03998	53,292	7,762.514	71,416.9883
57	.04353	51,161	7,200.109	63,654.4743
58	.04743	48,934	6,653.810	56,454.3653
59	.05173	46,613	6,123.876	49,800.5553

IMPAIRED LIFE TABLES

$q'_x = 250$ Per Cent q_x

$C^m(5)$ 3½ Per Cent

Age	q'_x	l_x	D_x	N_x
60	.05645	44,202	5,610.750	43,676.6793
61	.06160	41,707	5,115.023	38,065.9293
62	.06730	39,138	4,637.639	32,950.9063
63	.07355	36,504	4,179.251	28,313.2673
64	.08043	33,819	3,740.919	24,134.0163
65	.08795	31,099	3,323.714	20,393.0973
66	.09618	28,364	2,928.898	17,069.3833
67	.10520	25,636	2,557.684	14,140.4853
68	.11508	22,939	2,211.214	11,582.8013
69	.12588	20,299	1,890.560	9,371.5873
70	.13768	17,744	1,596.714	7,481.0273
71	.15060	15,301	1,330.317	5,884.3133
72	.16468	12,997	1,091.787	4,553.9963
73	.18003	10,857	881.179	3,462.2093
74	.19675	8,902	698.074	2,581.0303
75	.21503	7,151	541.802	1,882.9563
76	.23488	5,613	410.893	1,341.1543
77	.25648	4,295	303.778	930.2613
78	.28000	3,193	218.198	626.4833
79	.30540	2,299	151.793	408.2853
80	.33305	1,597	101.877	256.4923
81	.36293	1,065	65.642	154.6153
82	.39525	678	40.376	88.9733
83	.43025	410	23.590	48.5973
84	.46768	234	13.008	25.0073
85	.50818	125	6.714	11.993
86	.55178	61	3.166	5.2853
87	.59855	27	1.354	2.1193
88	.64845	11	.5329	.7653
89	.70158	4	.1872	.2324
90	.75840	1	.0452	.0452
91	.81813			
92	.88178			
93	.94685			
94	1.01808			
95	1.08740			
96	1.16908			
97	1.25000			
98	1.35135			
99	1.47060			

JAMES S. ELSTON: As Mr. Mead's paper reached me only two hours ago, an adequate discussion is impossible, but it is apparent that it is a valuable summary and analysis of the problem treated.

Under the section headed "General Considerations," however, I am afraid I cannot agree with Mr. Mead's conclusions that substandard rating should be based upon the American Experience Table in preference to the American Men Table. The concept of rating entirely upon the new table is somewhat difficult to grasp expecially because in practice it at first involves reasoning through the American Experience Table as an intermediate process. This appears clearest to me if all of the preconceptions and details are thrown into the background and the problems considered from fundamentals. When sufficient experience is accumulated all percentage extra mortality ratings should be based upon the company's standard or some table approximating thereto. If the underwriter intends to rate a case for 50 per cent extra mortality, it would be much simpler, after he is accustomed to the practice, to rate with reference to the standard mortality instead of with reference to what happens to be a legal standard in which he is not interested. In cases where definite ratings are assigned by the actuary or medical director to be applied to certain classes of applicants, the ratings could in the first place be determined with reference to the normal mortality on standard lives. This will be all the easier because most of our present substandard experience is in the M.A. investigation in which an attempt was made to use a true standard table as the basis of reference. In brief, underwriting of substandard risks should be with reference to the standard mortality expected in the future instead of with reference to what was the standard fifty years ago.

Not only do I fail to agree with the conclusion Mr. Mead draws, but I fail to agree with the reason by which he supports his conclusion. It is true that legal reserves are based upon the American Experience Table. It is not true that the premium rates in the largest non-participating companies are primarily based upon the American Experience Table, and I do not believe they should be except as a matter of adjustment. To hark back again to fundamentals, non-participating premium rates should be based upon the true facts in so far as they can be ascertained or approximated, including the true select mortality rate, the true expenses assessed as they are actually incurred, and the best conservative estimate possible of the interest rate to be experienced on the average during the lifetime of the policies (with allowance for the fact that comparatively few policies will be in force more than 25 years, though on those that do continue the reserve will be high). Premiums should be calculated with at least the refinement indicated in Mr. Cammack's paper in the *Transactions of the Actuarial Society* on "Premiums for Non-participating Life Insurances," preferably with adjustment for the average-sized policy as explained in the *Transactions* in my paper on "Expense Investigations and Some Other Statistical Problems Dependent Thereon." The premiums should then be checked up and modified if necessary by the "asset share" method illustrated in Mr. Cammack's paper. This method automatically allows, in so far as is necessary, for the reserves being based on the American Experience Table because the cash surrender values enter into the asset shares. The rates thus worked on a true basis should be adjusted to avoid the necessity for a legal premium deficiency reserve and to fit other legal and business requirements, all as a subsequent process. In other words, on the fundamental assumption that premiums should be a function of true values, they should be based upon the American Men Table and graded with reference to the American Experience Table, instead of being based upon the American Experience Table and graded with reference to the American Men Table. The same relative margin, as far as is implied in a common mortality base, may, therefore, as Mr. Mead suggests, be employed for substandard risks as for standard risks, assuming that the loadings for the fundamental premium and the extra premium are correctly adjusted to reflect all the factors involved.

A comparison of the extra premiums on percentage-rated cases on the American Experience and American Men Tables with comparisons of the amount of extra mortality which the extra premium at a given percentage on the American Experience Table would provide if interpreted in terms of the American Men Table may be of interest. In the following table the latter percentages are roughly and hurriedly interpolated on the basis of the extra premiums on the American Men Table given in Mr. Hunter's paper on "Under-average Business with Special Reference to the Problem of a Young Company," presented at this meeting.

NET EXTRA PREMIUMS PER $1,000 FOR ADDITIONAL MORTALITY

AGE AT ISSUE	ORDINARY LIFE			20-PAYMENT LIFE			20-ENDOWMENT		
	American Experience Net Extra Premium	Excess American Experience over A.M. Corresponding Rating	A.M. Per Cent Extra Mortality Corresponding to American	American Experience Net Extra Premium	Excess American Experience over A.M. Corresponding Rating	A.M. Per Cent Extra Mortality Corresponding to American	American Experience Net Extra Premium	Excess American Experience over A.M. Corresponding Rating	A.M. Per Cent Extra Mortality Corresponding to American
50 Per Cent Extra Mortality—American Experience									
20	$ 4.22	$1.52	80%	$ 5.10	$1.70	80%	$ 2.45	$1.25	100%
30	4.93	1.43	70	5.38	1.48	75	2.76	1.36	95
40	6.36	1.06	60	6.12	1.12	65	3.63	1.13	75
50	9.51	.81	55	8.43	.83	55	6.39	.89	60
60	16.67	1.37	55	15.30	1.50	55	14.25	1.55	55
100 Per Cent Extra Mortality—American Experience									
20	$ 8.23	$3.03	170%	$ 9.64	$3.34	160%	$ 4.23	$2.53	200%
30	9.53	2.83	150	10.12	3.02	150	5.58	2.68	200
40	12.21	2.31	130	11.54	2.34	130	7.34	2.34	150
50	18.23	1.73	115	16.16	1.76	115	12.91	1.91	120
60	32.20	3.10	110	30.02	3.22	110	28.54	3.44	115
150 Per Cent Extra Mortality—American Experience									
20	$12.12	$4.62	270%	$13.83	$4.83	230%	$ 7.47	$3.80	300%
30	13.94	4.44	250	14.49	4.49	220	8.46	4.16	300
40	17.73	3.53	190	16.56	3.36	200	11.12	3.62	220
50	26.46	2.76	170	23.56	2.86	175	19.53	2.93	175
60	46.99	5.09	170	44.38	5.28	170	42.71	5.51	175

The excess of the extra premiums on the American Experience Table over those for the corresponding rating over the American Men Table is of course due both to the fact that the latter allows for the lower mortality during the select period and also for the lower mortality at the younger ages. Some rough allowance for this excess has actually been made in some underwriting practice by being more liberal in substandard ratings at the younger ages.

Perhaps it will be advisable in practice for some time to come to cloak substandard ratings in the form of the American Experience Table, but assessment of extras will be more equitable and the problems involved will eventually be simplified if we strive toward reference to the true mortality rate.

Attention might be called to the section on "Reserves" under "General Considerations," where Mr. Mead states, "Therefore, it is better to use the reserves by the extra percentage tables which are intermediate between those for normal risks and those based on the rated-up age." He also states that this method also assists the agent because of the increased surrender values. These statements are true on life forms but not in general on endowment forms. This is probably understood by the author, inasmuch as he later says that in the case of change to a standard form there would be reduction in reserves "on life forms."

It will be interesting in connection with this paper to read that of Mr. Hoskins presented at the recent meeting of the Actuarial Society on "Incidence of Substandard Mortality."

Mr. Arthur Coburn: A great number of the points in connection with substandard business have already been covered. There is one point that has not been touched upon so far.

Assuming a thoroughly accurate knowledge of the amount of extra mortality to be anticipated and its probable incidence, we can readily determine the single premium that should be paid at the outset to cover that extra risk. Once that single premium has been determined, the general practice has been to divide it by an annuity, by a life annuity if it has been a life form, based upon that substandard mortality.

I question whether in all cases that is the proper procedure to follow. In certain types of substandard risks a large percentage of the insured recover from the impairment. I have in mind, as an example, cases of albuminuria. Many of the insured apply for reratings and in many instances the rating can be removed. It seems to me that the annuity that we use to divide this single premium by should not be a life annuity. It should be an annuity payable until death or until the life becomes standard. In some instances, use of such an annuity will produce a materially different extra premium.

MR. ADOLPH A. RYDGREN: Mr. Hunter's paper is timely, coming as it does at a time when so many young companies have recently extended or contemplate extending their operations to cover substandard insurance. I wish merely to call attention to one or two points referred to in the paper.

Mr. Hunter states: "Among underaverage risks as a whole, the ratio of the extra to the normal mortality decreases with the duration of the policy." He also states: "Furthermore, the company may base its provision for extra mortality on the assumption that it will be constant over a period of years, whereas in the majority of impairments there is a decreasing mortality relative to the normal."

These observations, coming from Mr. Hunter, may be considered as applying to any company freely accepting substandard business. These observations have a significance not mentioned by Mr. Hunter. There has been a great deal of doubt as to what reserves should be held under substandard business, and the practices of the companies vary considerably. Some companies which use the rated-age method hold reserves based on the rated age; other companies which use the extra premium method hold reserves based upon a multiple of the standard mortality table, using the same table employed in the calculation of the extra premiums; for example, both premiums and reserves may be computed on a mortality table formed by assuming a mortality of double the normal; other companies hold standard reserves at true ages at entry; probably no company holds reserves less than standard reserves at true ages at entry. It can be readily demonstrated that when the ratio of the extra to the normal mortality decreases with the duration of the policies, the theoretically correct reserve is less than the standard reserve at the rated age, and is less than the reserve according to the multiple mortality table used in the calculation of the extra premium; it may actually be less than the standard reserve at the true age at entry. Whether the theoretically correct reserve on the aggregate of the substandard business of a company is greater or less than the corresponding standard reserve at true age at entry depends upon the rate of diminution in the ratios of extra to normal mortality as the duration increases, and there will doubtless always be some variations in that rate even among those companies which freely accept substandard business. One thing, however, seems certain, that a company holding standard reserves at the rated age or holding reserves based upon the multiple mortality table employed in the calculation of premiums, is holding too much reserve; and what is more important, if it bases its surrender values upon the reserve held, it is allowing too large surrender values unless it has made a further addition to the premium for the express purpose of allowing such larger values.

I also wish to refer to the two methods most frequently employed in meeting the extra mortality, namely, the method of extra premiums, and the method of rating the age. Where the company commands the talent necessary to properly apply either of these methods, there is, of course, no financial difference, as far as the company is concerned, whichever method be adopted. Either method can be successfully and properly applied. Mr. Hunter has called attention to the simplicity of the extra premium method.

The rated-age method is more complicated. Mr. Hunter has explained the method of computing the advance in age required to provide for the extra mortality by determining the minimum number of years advance in age required to produce a net premium according to the normal mortality table higher than the net premium according to the substandard table. Under an ordinary life policy issued at age 30, where an extra mortality of 50 per cent of the normal is expected, the extra premium is $3.50, and the corresponding advance in age is six years, both extra premium and advance in age being computed on the assumption that the American Men Table represents normal mortality; but when we apply that six years advance in age to the American Experience Table we find that the net premium at age 36 is only $3.36 greater than the net premium at age 30. When the rated-age method is used, it is necessary to ascertain whether the loading in the premium at the rated age is sufficiently in excess of the loading at the true age to cover (1) the extra commissions and premium taxes, (2) the excess, if any, of the true extra premium over the difference in the net premiums by the American Experience Table, and (3) the difference in dividends between the rated age and the true age if dividends be allowed at the rated age; and if cash values at the rated age be allowed, an increase in the advance in age should be made to provide for such larger cash values.

I also wish to refer to Mr. Mead's paper. I want to refer again to the question of whether to compute extra premiums on the American Table or on the American Men Table. I represent one of the younger companies that Mr. Mead refers to and I think, inasmuch as we only very recently entered the substandard field, that it might be of help to know just the reasoning we applied in adopting the method we did.

There can be hardly any question, and I am sure Mr. Mead would not differ from me in the statement that the true net extra mortality, to provide for the extra mortality expected, is the difference between the net premium based on the multiple of the American Men Table and the net premium based on the American Men Table itself, provided that the company may assume that the American Men Table of mortality will represent its normal mortality in the company over a long period of years including a period during which an epidemic or a war may occur. That is an assumption which a great many companies can make.

The use of the American Experience Table in the same manner results in inconsistencies. Take, for example, a twenty-year endowment policy, on a 200 per cent mortality case. If we compute the extra premium on the basis of 200 per cent of the American Experience Table we would at age 21 get approximately—I have not figured this out but we would get approximately double the extra premium required to cover the extra mortality, whereas at age 50 or 60 we would get approximately the correct premium to cover it.

Now, having the net extra premium required to meet the extra mortality, what loading should be put upon that extra premium? We want to consider in the first place whether we intend to allow the same dividends under substandard business as under standard business, and if we want to allow different dividends, what dividends we wish to allow. I think that a young company entering the substandard field will not get enough experience for a great many years on its substandard business to make a real scientific distribution of dividends on its substandard business, if it wishes to vary from the standard business. Therefore I think a young company had better include in its addition to the normal premium the allowance it wishes to make, if any, for extra dividends. Then the extra premium must be loaded to cover at least the additional commissions allowed and the premium taxes. And then the extra premium might be loaded to cover perhaps a little extra profit to the company, if it wishes to make more profit on its substandard business than on its standard business.

Now, we also took up the question as to what reserves and case values to allow. I was concerned not so much with the possibility that our true reserve would be greater than the standard reserve at the true age of entry. I was more afraid that our reserve would be less than the standard reserve at the true age of entry. The plan distribution of our business is different from that of most companies. We have very little limited payment life on our books; our business is largely endowment and whole life, but mainly endowment. In our case I am afraid that the extra premiums we will get in the early years will, if our actual mortality follows the expected, be actually less than the expected, so that in allowing even standard cash values, I am afraid we are allowing too much. If we had decided to allow greater cash values than the standard we would have had to increase our premiums on substandard business. In other words, we would have to tax the policyholders who continue their policies in order to pay higher cash values to those who discontinue their policies.

I want to mention another point. It is conservative to hold standard reserves and to allow standard cash values rather than to hold larger reserves. I think that statement may be questioned by some, but I maintain that if we find that the extra premiums we have received over a period of years exceed the extra mortality incurred on our substandard business, I would much rather have that extra profit in our surplus than have it tied up in reserves which are a liability and which cannot be used in case of necessity.

MR. WITHINGTON: I wish to say, if I may, in connection with the subject under discussion, that I am in most emphatic disagreement with the statement made yesterday by one of the speakers that the American Experience Table has been "more or less discredited." I do not believe that, most decidedly. I think, on the contrary, the sufficiency and the advisability of standing on the American Experience Table has been most emphatically demonstrated. If we have not learned the lesson taught us by the influenza, I think our case may be regarded as well-nigh hopeless.

MR. E. G. FASSEL: I would like to briefly outline a practical method of actually writing the policy from the standpoint of a small company to which certain classes of substandard risks are acceptable.

Three common methods of handling substandard insurance are: (1) the rated-up age method with premium and guaranteed values as for a standard policy of higher age; (2) an extra premium method by which the guaranteed values are the same as for the true age; (3) an extra premium method by which the guaranteed values are based on a substandard mortality table.

Guaranteed values and the reserves carried under the rated-up age method are undoubtedly too great for life plans. On the other hand if an extra premium is charged and standard guarantees are incorporated in the policy, the guarantees and the reserves carried by the company are in many cases too low. The insertion of guaranteed values on the basis of substandard mortality tables is a very great obstacle to a small company because of the labor of providing complete sets of guarantees for the various substandard classes.

The practical solution herein suggested is to write the policy at the premium rate felt to be proper, and then incorporate guaranteed values as for a standard policy of higher age, such as to approximate what is felt to be the proper guarantees. For representative ages and plans the reserves at the end of, say, twenty years would be worked out upon what is considered to be a proper basis. The rated age would then be found for which the standard reserve at the end of twenty years is the same as the desired substandard reserve. Use of guarantees for the rated age thus obtained would provide a good approximation to the substandard guarantees for durations other than twenty years.

This involves tables of substandard premiums and tables of age ratings. The range of acceptable substandard business having been divided into, say, four classes, the company would publish in its rate book opposite the true age the premiums for Class A, Class B, etc. The labor of preparing such premiums is not great.

The actual writing of the policy would be as follows: Our particular case having been graded as, say, Class A, the policy is written at the published rate of premium for Class A. At the bottom of page 1 the statement is made that this policy belongs to Class A. On pages 2 and 3 there are references to "age" and to "attained age" under the non-forfeiture and the change provisions. These would be made to read "rated age" and "attained rated age." The age clause would be made to read substantially as follows: "If the age of the insured has been misstated the amount insured shall be such as the premium paid would have purchased at the premium rate for the correct age. In this policy the rated age is the true age increased by——years."

MR. GRAHAM: I know we are all looking forward very much to hearing the remarks of the next speaker. I am going to call on Mr. Moir.

MR. HENRY MOIR: One of the problems for a young company is to determine whether or not it should conduct a substandard business. In the selection of standard risks most of the companies are accepting as much as 85 per cent of all business submitted. Some of them go as high as 90 per cent, and you may safely say that the average young company accepts from 85 to 90 per cent as standard. There is a margin, averaging perhaps 12 per cent, that represents lost effort on the part of your agents. An important problem for any company is: How much of that can we save? All companies can save some of it, and it is a question of judgment as to the length a young company should go in effecting that salvage.

The experience of one company analyzed for about three years along those lines may interest you. About 88 per cent of the amount applied for was accepted standard. About 6 per cent was accepted substandard, and about 6 per cent declined. Of the 6 per cent declined there is still a possible salvage. Of the 6 per cent accepted as substandard from 75 to 80 per cent was placed and paid for. There was, therefore, a very considerable saving of expense, overhead charges, and so forth, in the placing of that business—also an increased personal income to agents.

The next question we come to is whether such business is desirable. In discussing this phase the two papers now before us show that there may be a difference of opinion. Where there are such differences, students will investigate before deciding on the best course. This is one of the subjects on which tolerance of the opinions of others is essential, because on the question of substandard business there are doubtless points of difference between any two of us, and the question of profit or loss should be decided on the broad average—not on small individual sections.

Mr. Coburn's remarks of course are correct, but we have to deal with these questions not as strictly mathematical, accurate matters, but on broad, general lines. You can't possibly determine that 50 per cent represents the extra mortality experience of any one class. You may *think* it does but what right have you to say that it is a percentage at all? Why shouldn't you say it is three per thousand extra. A percentage is an arbitrary assumption to begin with, and we are quite likely to change our viewpoint later.

Mr. Hunter discusses three systems and briefly refers to a fourth. Mr. Mead referred to the fourth system also in a vague way, his remarks being under the head of "Special Dividend Classes." But there is a system, used quite extensively, which deserves more than this passing mention—a general system in use by companies like the Metropolitan, the Equitable, the Travelers, the Prudential, and others. It implies a division of the mortality experience into (1) standard, and (2) two or three substandard grades. This system does not come under any of the groups described by Mr. Hunter or Mr. Mead. Yet it has great possibilities for broad classification and is extensively used.

You cannot expect to find substandard business that will exactly follow any one classification. It must be treated on broad lines. For example, the incidence of mortality has been discussed—whether it be increasing, decreasing, or constant. Some classes clearly show an increasing mortality, as, for example, overweights. Others just as clearly show a decreasing mortality, as, for instance, the classes showing tubercular family history with light weight at young ages, or heart murmur at young ages. The general result may be in accordance with what Mr. Beckett quoted as my remark of several years ago, that the general trend of extra mortality will be downward. I thought I made that remark principally in connection with occupational extras. But with the big class of heavyweights (that is one of the large groups of substandard business) I am not sure that it would show a definite downward trend, and an individual experience might readily show an increasing tendency, depending upon the admixture of the extra classes.

There is a great deal to be said in favor of the lien method for certain classes of extras. It should not be condemned in the wholesale way in which it has sometimes been. There are two classic papers on it which Mr. Mead referred to particularly: Mr. Sunderland's paper of 1891, and, even more important, Mr. George Hardy's fine mathematical paper of 1895, dealing with the system of extras as represented by deductions from the sum insured. Of course, we cannot use the method under our laws if we describe it as involving a deduction from the sum insured. What we have to do is to express our policy as promising an increasing sum insured. That is still possible.

But one of the fundamental assumptions made by Hardy was: "That the extra risk is so distributed throughout the above-mentioned period that the reserve value of a policy, subject to such temporary deduction, is the same as that of an ordinary policy of the same age at entry and duration." Beginning with that as a fundamental basis he gets results which do not differ materially from those obtained by Mr. Sunderland, who made no assumption as to reserve values. The important fact is that you may start with the fundamental assumption that the reserves are to be the same, and then work out your results. There are some classes of substandard policies where I think an extra reserve is desirable; others, where it is not. Taking it all in all, in a broad general way, I think Hardy's assumption is an excellent one for all classes combined. In my judgment, the assumption comes nearer the truth than that so commonly made, that the extra mortality is a percentage of the tabular, and of course the one is contradictory to the other.

That brings me to another point on which I want to go on record. Mr. Hunter says that an allowance is usually made to the insured of the difference between the cash value at the rated-up and original ages, if the insured obtains a reduction of the rating. Now, I do not like that emphatic statement from one whose words carry so much authority. There are many companies that do not make such an allowance, and with good reason for their attitude. If the extras are correct, or nearly correct, to begin with, and the insured ten years later applies for removal of the rating, in strict theory it should not be removed because the whole group is on that basis and if you remove the rating from the healthy you ought to increase it on the unhealthy. That is impracticable. As a practical proposition we must remove the rating. Otherwise the insured can take the full reserve under our present practice and go elsewhere, or even take a new standard policy with the same company. This condition may compel the removal of the rating, but I cannot see that a refund of the excess of the reserve over the normal reserve necessarily follows. That excess, as Mr. Mead indicates in his paper, can properly go to offset the additional mortality caused by withdrawal of the healthy from the group.

We talk too much theory in our actuarial societies. A personal friend of mine came into my office some thirteen years ago to take out life insurance. It was found that he had a heart murmur and he was passed with a rating. He spoke about the removal of the rating two years later, as he thought he was better. I suggested re-examination. I have seen him at intervals since but nothing more was said about his policy of insurance until a few weeks ago when he wrote saying that twelve years ago he had been rated and that he had a strong impression the rating had been removed. He had told other companies that the rating had been removed, and that he was now a standard risk, but, to his surprise, he found on looking at his policy that it was not so. Here was an alert business man who had been paying a heavy rating for twelve years without knowing it. He came to see our medical director, was re-examined, and the rating was removed. In these matters we are not dealing with an exact science or exact mathematical conditions. Indeed, I entirely agree with Mr. Evans' remark made yesterday that if people had absolute knowledge and did select against the company with pure reason, term extension would be a disastrous thing. Mr. Evans does not hold up that condition as a bogey. He said it on the same principle that he might say that if the moon would fall it would be a disaster to the earth. Of course it would.

With reference to Mr. Withington's remarks on the American Men Table, I think that in judging of the amount of extra to be imposed actuaries should use their own company standard, or a standard approximating it, and the best basis we have for that approximation just now is the American Men Table. Accordingly, as Mr. Phillips pointed out, we have to use this table, or one like it, in determining the extra.

Now, having determined that extra, say, 50 per cent more than the American Men Table for the class, I think it is not at all a bad thing to apply the same percentage to the American Experience Table, and thus get more extra. It would be the conservative thing to do, and in dealing with substandard business we should be conservative. We cannot get accurate averages in the different classes, and should, therefore, impose a little more than may be theoretically necessary to meet all those contingencies that arise later, including the removal of extras. It does not take many extra deaths to make a percentage difference at the younger ages by the American Men Table, since the tabular deaths per annum are only some three or four per thousand.

MR. MILLIGAN: Mr. Moir mentioned the company with which I am connected, and it seems that the interest of the members in this question justifies the taking of a little time to explain more fully just what our method of rating substandard business is. As Mr. Moir says, it was only touched incidentally in either one of the papers.

Before explaining our method I might complete the history of substandard business as given in Mr. Mead's paper. In 1896 the Metropolitan started its Intermediate Branch and in 1899 its Special Class Branch, thus naturally obtaining two broad groupings.

The premium rates for Intermediate risks were based upon a table constructed from our industrial experience, while the premium rates for Special Class risks were the same premium rates as charged on standard risks, but a lien was imposed based upon an assumed mortality of 200 per cent.

The business with both these classes was participating, but in the Special Class dividends were to be applied to reduce the liens. After the liens were canceled the policies became regular annual dividend policies with the dividends payable in cash.

The Armstrong investigation made it impossible for the company to write participating business after 1907 and accordingly two mortality tables were constructed from our then experience on Intermediate and Special Class policies. New tables of premiums and cash surrender values were prepared and policies issued as non-participating.

Our present practice is to classify risks according to four groups: The ordinary or standard risks, with premium rates based upon the American Experience Table of Mortality, the Intermediate, Special Class, and Special Class B risks with premiums based upon increased mortality.

In the standard group risks are accepted when the mortality is expected to be under 125 per cent of a mortality table such as the American Men or the Medico-Actuarial. In the Intermediate, risks are accepted where the mortality is expected to be from 125 per cent to 150 per cent; in the Special Class from 150 to 200 per cent; in the Special Class B from 200 to 250 per cent. These percentages of acceptance being based upon the American Men Table, a certain amount of margin naturally exists corresponding to excess mortality provided by the American Table. As now developed the ordinary department is practically divided into these four branches. Each branch has its own premium rates, its own reserves, its own bookkeeping, and its own dividends.

This system by reducing the number of substandard classifications reduces the border line cases, which are always troublesome. In addition, owing to the nature of our agency organization, a considerable volume of business is written where the applicant's occupation is hazardous. Our business is written exclusively by our agents and no business is accepted from brokers or general agents. The industrial agent canvasses nearly everybody he can find, and expects a premium rate to be named and a policy to be given; also the facts must be published in such a way that the men can tell the applicant exactly what kind of policy will be issued and what the premium rating will be.

This method might not be applicable for small issues, but if you have ever tried to make up an occupational rating schedule I think you will agree with Mr. Moir that there is considerable personal opinion reflected in the final result. The ratings of all the competing companies are available, as are also the few valuable insurance statistical and public service reports, but the information at the present time is hardly sufficiently complete or extended to permit of absolutely correct ratings.

The Special Class experience since 1899 includes such substandard cases as overweight, underweight, liquor dealers, family and personal history, extra hazardous occupations, albumin, sugar, impaired hearts. The experience of these groups is very nearly uniform with the exception of the impaired heart and sugar cases.

MR. PATTISON: I was very much interested in reading Mr. Hunter's paper and observing his method of obtaining the advance in age to correspond to a certain percentage extra mortality. As I understand it, Mr. Hunter obtains the rated-up age by taking the age at which the net premium for the plan applied for obtained from the standard table is slightly greater than the net premium at the true age obtained from the extra mortality table.

The comparisons shown in Mr. Hunter's paper are made by using the ordinary life plan. I have thought it would be rather interesting to prepare a set of ratings based upon a term plan rather than the ordinary life plan. By comparing ratings on the basis of a term plan we are better able to visualize the effect of the rating up in age method of handling substandard business. Ratings prepared in this manner show a considerably higher rating at the younger ages, as the following table will show.

YEARS RATING UP TO CORRESPOND TO A CONSTANT EXTRA MORTALITY

American $3\frac{1}{2}$ Per Cent 150 Per Cent q_x

Age	Years Rating up Based upon Ordinary Life	Years Rating up Based upon 10-Year Term	Years Rating up Based upon 20-Year Term
20	11	22	18
25	10	19	15
30	9	15	12
35	8	12	9
40	7	9	7
45	6	7	6
50	6	6	6
55	5	6	5

It is unfortunate that the above ratings were prepared upon the basis of the American Experience Table instead of the American Men Table as used by Mr. Hunter.

Inasmuch as Mr. Hunter's paper refers particularly to the problems of the younger companies, I believe that we should emphasize at this time the necessity of the younger companies, using very great caution when applying the rating up in age method, so that they will provide in their premiums and values for a mortality the curve of which will correspond to the curve which they would expect to experience.

For a young company with a comparatively limited surplus, it is perhaps more important to it that it should have released each year a sufficient proportion of the premium to cover the current mortality cost than it should have a large reserve built up for future contingencies. If a young company doing a rapidly increasing business were to issue policies to a large class of substandard risks, on which the mortality actually experienced should correspond to 150 per cent of the American Men Table throughout, and followed the rating up in age method, based upon the plan applied for in each case, or even based upon the ordinary life plan, then that company would show a constant loss from the mortality on such business each year for a number of years.

I am well aware that this objection to the rating up in age method has been fully covered already, but the objection can stand emphasizing because it is a very practical one. The rating up in age method may cover the extra hazard over the duration of the policy, but, except at the higher ages, or in those cases where the extra mortality is an increasing one, will not properly compensate a young company during the first ten policy years.

Mr. Mead in his paper referred to the fact that it was not possible any longer under the existing laws to issue a policy with a lien, and that it was necessary to write such policies in the form of increasing insurance on their face. Perhaps there may have been some reasonable foundation for the action of the legislatures in prohibiting the issuance of policies with liens. There is undoubtedly a considerable boomerang to the insurance business as a whole in the issuance of policies with liens, because of the particular fact that when a death claim is paid on one of these liened policies it is not paid to the insured but to the beneficiary, and where a payment is made to the beneficiary of less than the face of the policy, then the beneficiary always feels that the company has defrauded her in some manner or other. There has always been a strong doubt in my mind as to whether the insurance business as a whole has not lost because of the issuance of liened policies.

Mr. W. O. Morris: Reference has been made to a paper by Mr. Hoskins presented at the recent meeting of the Actuarial Society.

Mr. Hoskins selected from the report of the Medico-Actuarial Investigation a number of classes expected to show an increasing mortality. He then grouped the figures for these classes so as to produce approximate mortality rates by attained age at five-year intervals, eliminating the first five years of exposure. These rates, expressed as a percentage of the Medico-Actuarial Table, showed, in his words, a tendency to increase toward middle age and then decrease.

I have changed these percentages into terms of extra mortality per thousand and I think the results are extremely interesting. At attained ages 25 and 30, combined, the mortality rate is approximately the standard. At age 35 the additional deaths are 2 per thousand; age 40, 2.2; age 45, 2.7; age 50, 5.2; age 55, 7.3, and proceeding in five-year intervals 12.2, 14.4, 12.3, 21.1, and 43.9. Except at age 70, there is a continuous increase in the extra deaths per thousand. This seems to emphasize the danger of measuring substandard mortality by percentages of a standard table, and to show that comparisons based on percentages are apt to be misleading.

As an additional example, I took one of the groups of the M.-A. Investigation—underground miners, excluding coal miners (Class 44). This is a fairly large group, and one in which the extra mortality might be expected to decrease with advancing age. But, combining all age groups, the extra mortality per thousand during the first five years is 6.2; from the sixth to seventh year, 8.4; from the eighth to tenth year, 9.8; eleventh to fifteenth year, 13; and the sixteenth to the twenty-fourth year, 16. There is a definite increase in the death rate per thousand with increasing duration not revealed by the percentage method of comparison.

We have had some discussion today as to whether we should consider percentages of the American Men Table or base our calculations on additional percentages of the Amerlcan Experience Table. It seems to me that if we look at the additional loss as so many deaths per thousand we are in a very much better position to judge of the actual conditions.

It seems to me that the discussions at this meeting will have a marked influence on the transaction of substandard business by the companies represented in the Institute.

The tables that have been prepared by percentage modifications and by constant additions to the American Men Table are very valuable in showing in dollars and cents what those percentages and what those constant additions mean; but I want to go on record as being of the opinion that such percentage tables are not a proper basis for substandard insurance. It seems to me conclusively demonstrated by Mr. Hoskins' tables and by general considerations that substandard mortality will not, under usual conditions, correspond with any table constructed by a uniform percentage modification of a standard table.

It has been inferred that a small company should not do substandard business; that a non-participating company should not use the rated-up age method.

The North American Life has issued substandard policies since 1907. The volume anticipated at that time did not justify the preparation of special tables and policy forms and the rated-up age method was adopted. The selection of risks has been conservative and restricted to cases with moderate impairments. We have now about four millions of substandard insurance in force, about 7 per cent of our total business. Our experience is not large enough to produce figures of much value, but I can say that the amount freed for current mortality, from the extra premium collected, has been substantially equal to the extra death losses incurred. We have experienced some of the difficulties pointed out as objections to the rated-age method, but on the whole I believe that this business has been of distinct advantage to the company.

MR. MEAD: So many questions have been raised or implied in the discussion that it will be impossible to consider all of them.

It is my opinion that the same recognized methods should be used in connection with substandard insurance, whether a company is participating or non-participating, as is used in connection with standard insurance. I believe all, or practically all, of those who are in or are going into the substandard field will agree that the numerical method of rating is possibly the best for classifying risks. We hear a great deal of discussion today as to how various types of substandard risks should be treated. I do not see how this question is a matter of any greater concern in connection with substandard insurance than it is in connection with standard insurance. We have various types of risks which all recognize should be granted standard insurance and we never hear any discussion as to how they had best be treated, as practically all agree that they should be treated alike. Now we have standard risks whose mortality is practically average throughout life. In other words, there are 100 per cent risks throughout life and there are other types such as farmers, ministers, and school teachers who are perhaps about 80 per cent risks throughout life; and we have other types who are possibly 115 or 120 per cent throughout life. Then there are consumptive family history types where the mortality is 100 per cent on the average throughout life but might be 135 per cent in the earlier years and 80 or 90 per cent for the remainder of life. And then there are overweights who average 115 or 120 per cent for the whole of life but who in the earlier years have a mortality of only 80 or 90 per cent and late in life have a mortality of 130 or 140 per cent. We never hear any discussion as to how an individual standard risk is to be treated; they are all thrown into one broad group and graded 100 per cent. Why should it not be just as feasible to divide our substandard types into classes according as they are, on the average, 125 per cent risks, 150 per cent risks, and so on? It seems to me that if we attempt greater refinements we will inject unnecessary complications in our work. Why should we make our substandard business any more complicated than our standard business except where absolutely necessary?

Mr. Hunter has referred to the fact that large liens granted on endowment plans do not afford the protection which those risks require and that is quite true. However, it seems to me that that is the only feasible way for granting any insurance at all. While it is feasible to grant risks rated 200, 225, or even 250 per cent insurance at increased premiums, on the other hand it is not feasible to do so, for instance, in the case of a 400 per cent risk where the premium would be probably two and a half times the regular standard ordinary life premium. I think it will be impossible to interest anybody in any policy calling for such rates.

In his discussion Mr. Moir stated that Mr. Hunter referred to three systems of treating substandard insurance and that I referred, in addition, to a fourth and then he goes on to refer to another system like that used by the Metropolitan, Equitable, Travelers, etc. It seems to me that the systems of the companies just referred to are of the same type as referred to in method D of my paper, "Extra Premiums Based on Percentage Additions to the Standard

Mortality"; in other words, they all use special tables which vary by different degrees from the standard table. I am pleased to note, however, that, after criticizing the extra percentage or multiple table method to which I referred as method D, Mr. Moir agrees that probably the most feasible method is this multiple table method.

Mr. Milliken refers to the method used by his company which places its substandard risks in two broad groupings, intermediate and special class. This method, it seems to me, is but a type of the multiple table method.

Mr. Robertson Hunter, in his discussion, stated that in tracing the history of substandard insurance I left the impression that Great Britain played but little part in the development of the principles of substandard insurance. I believe a re-reading of the paper will indicate that I implied no such impression. At any rate if I did I desire to correct the impression by stating it was my intention to imply, rather, that while the development of the principles had been extensive yet on the other hand the true principles were often violated and often misunderstood by some of the best British actuaries. While, indeed, they have, for the most part, developed the actuarial principles involved yet it remained for the American companies to adopt the best methods in practice, namely, the use of multiple tables; furthermore, that while the British companies did so much in the development of the actuarial principles yet they seem to have made very little progress or advancement not only in the practical treatment of substandard risks but they made very little progress or advancement in knowledge of the mortality values of various types of risks. Their knowledge as to such values seems to have been, for the most part, hypothetical and from the hypothetical they proceed to develop the principles of rating substandard risks and fitting policies to risks so rated.

Mr. R. G. Hunter makes the statement that a company is not going to suffer financially by reason of the mortality curve being different by using the rated-up method so long as the extra premium is sufficient except when the matter of surrender value arises. It will suffer financially to the extent that its surplus for the time being will be depleted and this is a danger which would be very trying to most of our younger companies. In other words, it cannot attempt the rated-up-in-age method and do very much substandard business unless it is extremely well intrenched financially to undertake to put up the abnormally high reserves resulting from the rated-up-in-age method.

MR. ARTHUR HUNTER: Unfortunately I cannot reply to the various suggestions and criticisms which have been made in the review of my paper as I have just returned from a business trip abroad and cannot find the time to prepare the tables necessary to make a satisfactory reply. I appreciate very greatly the kindly references to my work, and also the courtesy of the various actuaries in preparing comments on my paper.

A reference to the experience recently completed by our company on underaverage lives may interest the readers. We have just completed an investigation into the mortality experience on policies issued with advance in age from 1907 to 1920 inclusive studied to the anniversaries of 1921. An idea of the extent of the data may be obtained from the fact that the number of policies which terminated by death was over 7,700 for an amount insured of $17,500,000. The expected mortality according to the company's experience on standard risks was calculated at the rated-up age, and the actual deaths were in close agreement with the expected on this basis. In other words, if the same amount of insurance had been written on standard risks at ages corresponding to the rated-up ages in this substandard group the actual deaths would have been practically the same as found in the investigation. The relative mortality on cases rated above 200 per cent was slightly higher than among those with a lower numerical rating. Several reasons may be suggested for this, the chief of which may be that there is a selection against the company on the highly rated risks as the larger the number of years' advance in age the smaller is the percentage of policies placed.

IMPAIRED LIFE TABLES

COMMUTATION COLUMNS BASED ON THE AMERICAN MEN (SELECT) MORTALITY TABLE AND 3½ PER CENT INTEREST WITH A PERCENTAGE OR CONSTANT ADDED TO THE STANDARD RATE OF MORTALITY

The tables submitted herewith were all based on the American Men (Select) Mortality Table as published on page 25 of the *American-Canadian Mortality Investigation* published by the Actuarial Society with the co-operation of the American Institute of Actuaries and the National Convention of Insurance Commissioners in 1918. The rate of interest used was 3½ per cent.

The rate of mortality as given in the American-Canadian Investigation was first of all increased by the percentage or constant indicated at the head of each table, and starting with a radix of 100,000 at age 15, a modified table of l_x derived by the usual formula $l_{x+1}=p_x \cdot l_x$. Then starting from ultimate age 20,

$$l_{(x)+4}\,,\quad l_{(x)+3}\,,\quad l_{(x)+2}\,,\quad l_{(x)+1}\,,\quad \text{and } l_{(x)}$$

were derived from the $l_{(x)+5}$, or ultimate, column as follows:

$$l_{(x)+4}=\frac{l_{(x)+5}}{p_{(x)+4}}\,;\quad l_{(x)+3}=\frac{l_{(x)+4}}{p_{(x)+3}}\,,\text{ and so on.}$$

The $d_{(x)}$ columns were derived by differencing the $l_{(x)}$ columns and $D_{(x)}$ and $C_{(x)}$ calculated from $v^x l_{(x)}$ and $v^{x+1} d_{(x)}$. The $N_{(x)}$ and $M_{(x)}$ columns were formed in the usual way by summing the $D_{(x)}$ and $C_{(x)}$ columns respectively:

$$N_{(x)}=D_{(x)}+D_{(x)+1}+D_{(x)+2}\,,\text{ etc.}$$

$$M_{(x)}=C_{(x)}+C_{(x)+1}+C_{(x)+2}\,,\text{ etc.}$$

IMPAIRED LIFE TABLES*

AMERICAN MEN $3\frac{1}{2}$ PER CENT

150 Per Cent $qx = q'x$

OUTLINE OF METHOD USED IN CALCULATING TABLE

q'_x columns constructed from q_x columns, pages 182–83, Vol. II, *American Canadian Mortality Investigation.* Six places of decimals were retained in q'_x, or one more place than that for q_x.

Entire Ultimate Table computed first.

Radix for Ultimate Table, 100,000 at age 15.

d_x column computed by repeated multiplications of l_x column by q'_x, the l_x column being reduced by each d_x as computed. After l_x and d_x columns were completed as above outlined, the l_x column was checked by the relation $l_x(p'_x) = l_{x+1}$.

The test $\Sigma d_x = 100{,}000$ was made of the d_x column.

Select Mortality Table was computed by the relation:

$$l_{(x)+4}(1 - q_{(x)+4}) = l_{(x)+5}\ ;$$

or

$$l_{(x)+4} = \frac{l_{(x)+5}}{p_{(x)+4}}$$

Similarly

$$l_{(x)+3} = \frac{l_{(x)+4}}{p_{(x)+3}}\ ,\ \text{etc.}$$

After $l_{(x)}$ was obtained for each fifth age, the process above outlined for calculating the Ultimate l_x and d_x columns was used to check the Select Tables back to the Ultimate Tables.

The check $\Sigma q'_x = 1.50\ \Sigma q_x$ was applied to both the Select and the Ultimate Tables, as were also the relations

$$vD_x - D_{x+1} = C_x,$$

and

$$vN_x - N_{x+1} = M_x$$

---

* Calculated by Southland Life Insurance Company.

The following test was made for age 15:

$$ {}_{10}V_{(15)} = 1 - \frac{1 + a_{(15)+10}}{1 + a_{(15)}} = \frac{M_{(15)}}{N_{(15)}} \cdot \frac{N_{(15)} - N_{25}}{D_{25}} - \left\{ \frac{M_{(15)} - M_{25}}{D_{25}} \right\} $$

$$ = 1 - \frac{N_{25}}{D_{25}} \div \frac{N_{(15)}}{D_{(15)}} $$

$$ 80.28 = 80.28 $$

SELECT NET ANNUAL PREMIUMS PER $1,000

Age	Ordinary Life	Twenty-Payment Life	Twenty-Year Endowment
15...........	$11.65	$18.25	$37.42
20...........	13.36	20.24	37.67
25...........	15.44	22.49	37.92
30...........	18.15	25.23	38.40
35...........	21.83	28.75	39.48
40...........	26.77	33.29	41.51
45...........	33.37	39.11	44.93
50...........	42.14	46.74	50.44
55...........	53.78	56.97	58.97
60...........	69.21	70.98	71.84
65...........	89.64	90.33	90.59

Age at Entry (x)	$D_{(x)}$	$D_{(x)+1}$	$D_{(x)+2}$	$D_{(x)+3}$	$D_{(x)+4}$	$D_{(x)+5}$	Age Attained $(x+5)$
15	59,532.08	57,305.54	55,098.54	52,962.89	50,899.32	48,903.68	20
16	....	....	....	....	....	46,972.19	21
17	....	....	....	....	....	45,110.24	22
18	....	....	....	....	....	43,315.52	23
19	....	....	....	....	....	41,588.41	24
20	48,736.33	46,895.47	45,065.67	43,293.31	41,580.96	39,926.04	25
21	....	....	....	....	....	38,326.49	26
22	....	....	....	....	....	36,788.67	27
23	....	....	....	....	....	35,310.66	28
24	....	....	....	....	....	33,890.91	29
25	39,763.12	38,249.63	36,743.24	35,286.61	33,882.80	32,527.15	30
26	....	....	....	....	....	31,216.87	31
27	....	....	....	....	....	29,958.68	32
28	....	....	....	....	....	28,749.89	33
29	....	....	....	....	....	27,586.42	34
30	32,380.01	31,143.89	29,913.45	28,723.86	27,576.80	26,466.36	35
31	....	....	....	....	....	25,387.90	36
32	....	....	....	....	....	24,347.63	37
33	....	....	....	....	....	23,343.54	38
34	....	....	....	....	....	22,374.30	39
35	26,319.97	25,309.35	24,296.10	23,313.51	22,363.06	21,437.34	40
36	....	....	....	....	....	20,530.85	41
37	....	....	....	....	....	19,653.37	42
38	....	....	....	....	....	18,802.52	43
39	....	....	....	....	....	17,977.52	44
40	21,268.37	20,434.70	19,589.94	18,765.74	17,963.43	17,176.27	45
41	....	....	....	....	....	16,397.78	46
42	....	....	....	....	....	15,640.77	47
43	....	....	....	....	....	14,903.75	48
44	....	....	....	....	....	14,186.08	49
45	16,965.95	16,273.67	15,560.57	14,858.10	14,169.21	13,486.30	50
46	....	....	....	....	....	12,803.96	51
47	....	....	....	....	....	12,138.30	52
48	....	....	....	....	....	11,488.17	53
49	....	....	....	....	....	10,853.62	54
50	13,223.99	12,646.88	12,039.68	11,433.43	10,833.80	10,233.61	55
51	....	....	....	....	....	9,628.417	56
52	....	....	....	....	....	9,037.394	57
53	....	....	....	....	....	8,460.785	58
54	....	....	....	....	....	7,898.648	59
55	9,916.416	9,438.185	8,921.147	8,398.100	7,876.708	7,351.146	60
56	....	....	....	....	....	6,818.271	61
57	....	....	....	....	....	6,300.827	62
58	....	....	....	....	....	5,799.364	63
59	....	....	....	....	....	5,314.320	64
60	6,992.303	6,604.629	6,173.563	5,732.618	5,291.643	4,846.688	65
61	....	....	....	....	....	4,397.167	66
62	....	....	....	....	....	3,966.923	67
63	....	....	....	....	....	3,556.605	68
64	....	....	....	....	....	3,167.449	69
65	4,479.678	4,181.971	3,842.511	3,493.658	3,146.773	2,800.367	70

Age at Entry (x)	$C_{(x)}$	$C_{(x)+1}$	$C_{(x)+2}$	$C_{(x)+3}$	$C_{(x)+4}$	$C_{(x)+5}$	Age Attained $(x+5)$
15	213.3812	269.1294	272.4107	272.5616	274.4010	277.7466	20
16						273.5148	21
17						269.2516	22
18						262.3363	23
19						256.0039	24
20	192.7716	243.9583	248.4005	248.3217	248.8104	249.3910	25
21						241.7475	26
22						233.9541	27
23						225.6739	28
24						217.6861	29
25	168.8500	212.9116	214.1081	210.5552	209.8480	210.3247	30
26						202.5471	31
27						195.6977	32
28						191.2533	33
29						187.1856	34
30	141.1344	177.2703	178.0239	175.7295	177.8863	183.4641	35
31						181.7405	36
32						180.7353	37
33						179.8518	38
34						180.3368	39
35	120.5704	157.3778	160.9843	162.0758	169.4762	181.5594	40
36						183.2004	41
37						186.3452	42
38						189.0670	43
39						193.3072	44
40	114.4507	153.7280	161.7422	167.7180	179.6970	197.6601	45
41						202.4901	46
42						208.1101	47
43						213.6742	48
44						220.0566	49
45	118.5550	162.7862	176.2702	186.4321	203.7628	226.2819	50
46						232.6703	51
47						239.6599	52
48						246.0667	53
49						252.9721	54
50	129.9218	179.5172	199.1244	212.9874	233.8258	259.1291	55
51						265.4249	56
52						270.9986	57
53						276.0231	58
54						280.3979	59
55	142.8925	197.8724	221.3676	237.3982	259.1998	284.2837	60
56						286.8752	61
57						288.3840	62
58						288.9287	63
59						287.9221	64
60	151.2173	207.7209	232.1807	247.1159	266.0126	285.6202	65
61						281.5487	66
62						276.1728	67
63						268.8825	68
64						259.9698	69
65	146.2177	198.0419	218.9140	228.7410	239.9929	249.4398	70

Age Entry (x)	$N_{(x)}$	$N_{(x)+1}$	$N_{(x)+2}$	$N_{(x)+3}$	$N_{(x)+4}$	$N_{(x)+5}$	Age Attained $(x+5)$
15	1309,284.74	1249,752.66	1192,447.12	1137,348.58	1084,385.69	1033,486.37	20
16						984,582.69	21
17						937,610.50	22
18						892,500.26	23
19						849,184.74	24
20	1033,168.07	984,431.74	937,536.27	892,470.60	849,177.29	807,596.33	25
21						767,670.29	26
22						729,343.80	27
23						692,555.13	28
24						657,244.47	29
25	807,278.96	767,515.84	729,266.21	692,522.97	657,236.36	623,353.56	30
26						590,826.41	31
27						559,609.54	32
28						529,650.86	33
29						500,900.97	34
30	623,052.56	590,672.55	559,528.66	529,615.21	500,891.35	473,314.55	35
31						446,848.19	36
32						421,460.29	37
33						397,112.66	38
34						373,769.12	39
35	472,996.81	446,676.84	421,367.49	397,071.39	373,757.88	351,394.82	40
36						329,957.48	41
37						309,426.63	42
38						289,773.26	43
39						270,970.84	44
40	351,015.50	329,747.13	309,312.43	289,722.49	270,956.75	252,993.32	45
41						235,817.05	46
42						219,419.27	47
43						203,778.50	48
44						188,874.75	49
45	252,516.17	235,550.22	219,276.55	203,715.98	188,857.88	174,688.67	50
46						161,202.37	51
47						148,398.41	52
48						136,260.11	53
49						124,771.94	54
50	174,096.10	160,872.11	148,225.23	136,185.55	124,752.12	113,918.32	55
51						103,684.705	56
52						94,056.288	57
53						85,018.894	58
54						76,558.109	59
55	113,210.017	103,293.601	93,855.416	84,934.269	76,536.169	68,659.461	60
56						61,308.315	61
57						54,490.04	62
58						48,189.217	63
59						42,389.853	64
60	67,870.289	60,877.986	54,273.357	48,099.794	42,367.176	37,075.533	65
61						32,228.845	66
62						27,831.678	67
63						23,864.755	68
64						20,308.150	69
65	36,285.292	31,805.614	27,623.643	23,781.132	20,287.474	17,140.701	70

Age at Entry (x)	$M_{(x)}$	$M_{(x)+1}$	$M_{(x)+2}$	$M_{(x)+3}$	$M_{(x)+4}$	$M_{(x)+5}$	Age Attained (x+5)
15	15,256.7508	15,043.3696	14,774.2402	14,501.8295	14,229.2679	13,954.8669	20
16						13,677.1203	21
17						13,403.6055	22
18						13,134.3539	23
19						12,872.0176	24
20	13,798.2762	13,605.5046	13,361.5463	13,113.1458	12,864.8241	12,616.0137	25
21						12,366.6227	26
22						12,124.8752	27
23						11,890.9211	28
24						11,665.2472	29
25	12,463.8340	12,294.9840	12,082.0724	11,867.9643	11,657.4091	11,447.5611	30
26						11,237.2364	31
27						11,034.6893	32
28						10,838.9916	33
29						10,647.7383	34
30	11,310.5971	11,169.4627	10,992.1924	10,814.1685	10,638.4390	10,460.5527	35
31						10,277.0886	36
32						10,095.3481	37
33						9,914.6128	38
34						9,734.7610	39
35	10,324.9087	10,204.3383	10,046.9605	9,885.9762	9,723.9004	9,554.4242	40
36						9,372.8648	41
37						9,189.6644	42
38						9,003.3192	43
39						8,814.2513	44
40	9,398.2800	9,283.8293	9,130.1013	8,968.3591	8,800.6411	8,620.9441	45
41						8,423.2840	46
42						8,220.7939	47
43						8,012.6838	48
44						7,799.0096	49
45	8,426.7593	8,308.2043	8,145.4181	7,969.1479	7,782.7158	7,578.9530	50
46						7,352.6711	51
47						7,120.0008	52
48						6,880.3409	53
49						6,634.2742	54
50	7,336.6787	7,206.7569	7,027.2397	6,828.1153	6,615.1279	6,381.3021	55
51						6,122.1730	56
52						5,856.7481	57
53						5,585.7495	58
54						5,309.7264	59
55	6,088.0590	5,945.1665	5,747.2941	5,525.9265	5,288.5283	5,029.3285	60
56						4,745.0448	61
57						4,458.1696	62
58						4,169.7756	63
59						3,880.8469	64
60	4,697.1722	4,545.9549	4,338.2340	4,106.0533	3,858.9374	3,592.9248	65
61						3,307.3046	66
62						3,025.7559	67
63						2,749.5831	68
64						2,480.7006	69
65	3,252.6383	3,106.4206	2,908.3787	2,689.4647	2,460.7237	2,220.7308	70

Age	D_x	C_x	N_x	M_x
71.........	2,456.230	237.4765	14,340.334	1,971.2910
72.........	2,135.692	223.8456	11,884.104	1,733.8145
73.........	1,839.625	208.9832	9,748.4121	1,509.9689
74.........	1,568.432	193.0515	7,908.7871	1,300.9857
75.........	1,322.342	176.2015	6,340.3551	1,107.9342
76.........	1,101.424	158.8558	5,018.0131	931.73267
77.........	905.3224	141.2515	3,916.5891	772.87687
78.........	733.4557	123.6659	3,011.2667	631.62537
79.........	584.9868	106.5341	2,277.8110	507.95947
80.........	458.6709	90.23452	1,692.8242	401.42537
81.........	352.9254	74.91554	1,234.1533	311.19085
82.........	266.0752	60.87468	881.22792	236.27531
83.........	196.2029	48.36487	615.15272	175.40063
84.........	141.2032	37.49091	418.94982	127.03576
85.........	98.93732	28.28305	277.74662	89.544849
86.........	67.30846	20.65793	178.80930	61.261799
87.........	44.37443	14.63039	111.50084	40.603869
88.........	28.24344	9.969848	67.126406	25.973479
89.........	17.31852	6.557480	38.882966	16.003631
90.........	10.17540	4.150987	21.564446	9.446151
91.........	5.68030	2.448586	11.389046	5.295164
92.........	3.03962	1.427629	5.7087456	2.846578
93.........	1.50921	0.7487919	2.6691256	1.418949
94.........	.709382	0.3807740	1.1599156	.6701573
95.........	.304619	0.1839485	.4505336	.2893833
96.........	.110369	.0710912	.1459146	.1054348
97.........	.0355456	.0343436	.0355456	.0343436

Age (x)	$q_{(x)}$	$q_{(x)+1}$	$q_{(x)+2}$	$q_{(x)+3}$	$q_{(x)+4}$	$q_{(x)+5}$	Age Attained $(x+5)$
15	.003705	.004860	.005115	.005325	.005580	.005880	20
16						.006030	21
17						.006180	22
18						.006270	23
19						.006375	24
20	.004095	.005385	.005700	.005940	.006195	.006465	25
21						.006525	26
22						.006585	27
23						.006615	28
24						.006645	29
25	.004395	.005760	.006030	.006180	.006405	.006690	30
26						.006720	31
27						.006765	32
28						.006885	33
29						.007020	34
30	.004515	.005895	.006165	.006330	.006675	.007170	35
31						.007410	36
32						.007680	37
33						.007980	38
34						.008340	39
35	.004740	.006435	.006855	.007200	.007845	.008760	40
36						.009240	41
37						.009810	42
38						.010410	43
39						.011130	44
40	.005565	.007785	.008550	.009255	.010350	.011910	45
41						.012780	46
42						.013770	47
43						.014835	48
44						.016050	49
45	.007230	.010350	.011730	.012990	.014880	.017370	50
46						.018810	51
47						.020430	52
48						.022170	53
49						.024120	54
50	.010170	.014685	.017115	.019275	.022335	.026205	55
51						.028530	56
52						.031035	57
53						.033765	58
54						.036735	59
55	.014910	.021705	.025680	.029265	.034065	.040020	60
56						.043545	61
57						.047370	62
58						.051555	63
59						.056070	64
60	.022380	.032550	.038925	.044610	.052020	.060990	65
61						.066270	66
62						.072045	67
63						.078240	68
64						.084960	69
65	.033780	.049005	.058965	.067755	.078945	.092205	70

Age at Entry (x)	$l_{(x)}$	$l_{(x)+1}$	$l_{(x)+2}$	$l_{(x)+3}$	$l_{(x)+4}$	$l_{(x)+5}$	Age Attained ($x+5$)
15	99,737	99,367	98,884	98,378	97,854	97,308	20
16						96,736	21
17						96,153	22
18						95,559	23
19						94,960	24
20	96,975	96,578	96,058	95,510	94,943	94,355	25
21						93,745	26
22						93,133	27
23						92,520	28
24						91,908	29
25	93,970	93,557	93,018	92,457	91,886	91,297	30
26						90,686	31
27						90,077	32
28						89,468	33
29						88,852	34
30	90,884	90,474	89,941	89,387	88,821	88,228	35
31						87,595	36
32						86,946	37
33						86,278	38
34						85,590	39
35	87,740	87,324	86,762	86,167	85,547	84,876	40
36						84,132	41
37						83,355	42
38						82,537	43
39						81,678	44
40	84,207	83,738	83,086	82,376	81,614	80,769	45
41						79,807	46
42						78,787	47
43						77,702	48
44						76,549	49
45	79,780	79,203	78,383	77,464	76,458	75,320	50
46						74,012	51
47						72,620	52
48						71,136	53
49						69,559	54
50	73,855	73,104	72,030	70,797	69,432	67,881	55
51						66,102	56
52						64,216	57
53						62,223	58
54						60,122	59
55	65,777	64,796	63,390	61,762	59,955	57,913	60
56						55,595	61
57						53,174	62
58						50,655	63
59						48,043	64
60	55,086	53,853	52,100	50,072	47,838	45,349	65
61						42,583	66
62						39,761	67
63						36,896	68
64						34,009	69
65	41,915	40,499	38,514	36,243	33,787	31,120	70

Age at Entry (x)	$d_{(x)}$	$d_{(x)+1}$	$d_{(x)+2}$	$d_{(x)+3}$	$d_{(x)+4}$	$d_{(x)+5}$	Age Attained ($x+5$)
15	370	483	506	524	546	572	20
16						583	21
17						594	22
18						599	23
19						605	24
20	397	520	548	567	588	610	25
21						612	26
22						613	27
23						612	28
24						611	29
25	413	539	561	571	589	611	30
26						609	31
27						609	32
28						616	33
29						624	34
30	410	533	554	566	593	633	35
31						649	36
32						668	37
33						688	38
34						714	39
35	416	562	595	620	671	744	40
36						777	41
37						818	42
38						859	43
39						909	44
40	469	652	710	762	845	962	45
41						1,020	46
42						1,085	47
43						1,153	48
44						1,229	49
45	577	820	919	1,006	1,138	1,308	50
46						1,392	51
47						1,484	52
48						1,577	53
49						1,678	54
50	751	1,074	1,233	1,365	1,551	1,779	55
51						1,886	56
52						1,993	57
53						2,101	58
54						2,209	59
55	981	1,406	1,628	1,807	2,042	2,318	60
56						2,421	61
57						2,519	62
58						2,612	63
59						2,694	64
60	1,233	1,753	2,028	2,234	2,489	2,766	65
61						2,822	66
62						2,865	67
63						2,887	68
64						2,889	69
65	1,416	1,985	2,271	2,456	2,667	2,869	70

Age	q_x	l_x	d_x
71	.100050	28251	2827
72	.108495	25424	2758
73	.117585	22666	2665
74	.127380	20001	2548
75	.137910	17453	2407
76	.149265	15046	2246
77	.161475	12800	2067
78	.174465	10733	1873
79	.188535	8860	1670
80	.203610	7190	1464
81	.219630	5726	1258
82	.236805	4468	1058
83	.255075	3410	870
84	.274725	2540	698
85	.295605	1842	545
86	.317700	1297	412
87	.340935	885	302
88	.366120	583	213
89	.392550	370	145
90	.420525	225	95
91	.449190	130	58
92	.481620	72	35
93	.512820	37	19
94	.545460	18	10
95	.581640	8	5
96	.616665	3	2
97	.665100	1	1

IMPAIRED LIFE TABLES*

AMERICAN MEN $3\frac{1}{2}$ PER CENT

200 Per Cent q_x

SELECT NET ANNUAL PREMIUMS PER $1,000

Age	Ordinary Life	Twenty-Payment Life	Twenty-Year Endowment
20	$15.81	$23.15	$38.86
30	21.28	28.45	39.84
40	31.41	37.48	44.00
50	49.90	53.51	55.96
60	83.00	83.91	84.28

---

* Calculated by Missouri State Life Insurance Company, February, 1922.

Age at Entry (x)	$q_{(x)}$	$q_{(x)+1}$	$q_{(x)+2}$	$q_{(x)+3}$	$q_{(x)+4}$	$q_{(x)+5}$	Age Attained $(x+5)$
15						.00784	20
16						.00804	21
17						.00824	22
18						.00836	23
19						.00850	24
20	.00546	.00718	.00760	.00792	.00826	.00862	25
21						.00870	26
22						.00878	27
23						.00882	28
24						.00886	29
25						.00892	30
26						.00896	31
27						.00902	32
28						.00918	33
29						.00936	34
30	.00602	.00786	.00822	.00844	.00890	.00956	35
31						.00988	36
32						.01024	37
33						.01064	38
34						.01112	39
35						.01168	40
36						.01232	41
37						.01308	42
38						.01388	43
39						.01484	44
40	.00742	.01038	.01140	.01234	.01380	.01588	45
41						.01704	46
42						.01836	47
43						.01978	48
44						.02140	49
45						.02316	50
46						.02508	51
47						.02724	52
48						.02956	53
49						.03216	54
50	.01356	.01958	.02282	.02570	.02978	.03494	55
51						.03804	56
52						.04138	57
53						.04502	58
54						.04898	59
55						.05336	60
56						.05806	61
57						.06316	62
58						.06874	63
59						.07476	64
60	.02984	.04340	.05190	.05948	.06936	.08132	65
61						.08836	66
62						.09606	67
63						.10432	68
64						.11328	69
65						.12294	70

Age at Entry (x)	$l_{(x)}$	$l_{(x)+1}$	$l_{(x)+2}$	$l_{(x)+3}$	$l_{(x)+4}$	$l_{(x)+5}$	Age Attained $(x+5)$
15						96,425	20
16						95,669	21
17						94,900	22
18						94,118	23
19						93,331	24
20	95,983	95,459	94,774	94,054	93,309	92,538	25
21						91,740	26
22						90,942	27
23						90,144	28
24						89,349	29
25						88,557	30
26						87,767	31
27						86,981	32
28						86,196	33
29						85,405	34
30	88,024	87,494	86,806	86,093	85,366	84,606	35
31						83,797	36
32						82,969	37
33						82,119	38
34						81,245	39
35						80,342	40
36						79,404	41
37						78,426	42
38						77,400	43
39						76,326	44
40	79,497	78,907	78,088	77,198	76,245	75,193	45
41						73,999	46
42						72,738	47
43						71,403	48
44						69,991	49
45						68,493	50
46						66,907	51
47						65,229	52
48						63,452	53
49						61,576	54
50	66,711	65,806	64,518	63,045	61,425	59,596	55
51						57,514	56
52						55,326	57
53						53,037	58
54						50,649	59
55						48,168	60
56						45,598	61
57						42,951	62
58						40,238	63
59						37,472	64
60	45,018	43,674	41,779	39,611	37,255	34,671	65
61						31,852	66
62						29,038	67
63						26,249	68
64						23,511	69
65						20,848	70

Age at Entry (x)	$d_{(x)}$	$d_{(x)+1}$	$d_{(x)+2}$	$d_{(x)+3}$	$d_{(x)+4}$	$d_{(x)+5}$	Age Attained $(x+5)$
15						756	20
16						769	21
17						782	22
18						787	23
19						793	24
20	524	685	720	745	771	798	25
21						798	26
22						798	27
23						795	28
24						792	29
25						790	30
26						786	31
27						785	32
28						791	33
29						799	34
30	530	688	714	727	760	809	35
31						828	36
32						850	37
33						874	38
34						903	39
35						938	40
36						978	41
37						1026	42
38						1074	43
39						1133	44
40	590	819	890	953	1052	1194	45
41						1261	46
42						1335	47
43						1412	48
44						1498	49
45						1586	50
46						1678	51
47						1777	52
48						1876	53
49						1980	54
50	905	1288	1472	1620	1829	2082	55
51						2188	56
52						2289	57
53						2388	58
54						2481	59
55						2570	60
56						2647	61
57						2713	62
58						2766	63
59						2801	64
60	1343	1895	2168	2356	2584	2819	65
61						2814	66
62						2789	67
63						2738	68
64						2663	69
65						2563	70

Age	q_x	l_x	d_x
71	.13340	18285	2439
72	.14466	15846	2292
73	.15678	13554	2125
74	.16984	11429	1941
75	.18388	9488	1745
76	.19902	7743	1541
77	.21530	6202	1335
78	.23262	4867	1132
79	.25138	3735	939
80	.27148	2796	759
81	.29284	2037	597
82	.31574	1440	455
83	.34010	985	335
84	.36630	650	238
85	.39414	412	162
86	.42360	250	106
87	.45458	144	65
88	.48816	79	39
89	.52340	40	21
90	.56070	19	11
91	.59892	8	5
92	.64216	3	2
93	.68376	1	1
94	.72728	....	....
95	.77552	....	....
96	.82222	....	....
97	.88680	....	....
98	.91526	....	....
99	1.00000	....	....

Age at Entry (x)	D_x	$D_{(x)+1}$	$D_{(x)+2}$	$D_{(x)+3}$	$D_{(x)+4}$	$D_{(x)+5}$	Age Attained $(x+5)$
15	...	...	...	...	...	48,459.91	20
16	...	...	...	...	...	46,454.08	21
17	...	...	...	...	...	44,522.39	22
18	...	...	...	...	...	42,662.34	23
19	...	...	...	...	...	40,874.98	24
20	48,237.78	46,352.11	44,463.28	42,633.33	40,865.34	39,157.18	25
21	...	...	...	...	...	37,506.77	26
22	...	...	...	...	...	35,923.20	27
23	...	...	...	...	...	34,403.85	28
24	...	...	...	...	...	32,947.28	29
25	...	...	...	...	...	31,550.95	30
26	...	...	...	...	...	30,212.07	31
27	...	...	...	...	...	28,928.99	32
28	...	...	...	...	...	27,698.46	33
29	...	...	...	...	...	26,516.21	34
30	31,361.05	30,118.09	28,870.78	27,665.36	26,504.10	25,379.84	35
31	...	...	...	...	...	24,287.11	36
32	...	...	...	...	...	23,233.94	37
33	...	...	...	...	...	22,218.28	38
34	...	...	...	...	...	21,238.46	39
35	...	...	...	...	...	20,292.18	40
36	...	...	...	...	...	19,377.07	41
37	...	...	...	...	...	18,491.21	42
38	...	...	...	...	...	17,632.18	43
39	...	...	...	...	...	16,799.53	44
40	20,078.75	19,255.78	18,411.52	17,586.16	16,781.70	15,990.49	45
41	...	...	...	...	...	15,204.42	46
42	...	...	...	...	...	14,439.92	47
43	...	...	...	...	...	13,695.56	48
44	...	...	...	...	...	12,970.75	49
45	...	...	...	...	...	12,263.90	50
46	...	...	...	...	...	11,574.81	51
47	...	...	...	...	...	10,902.91	52
48	...	...	...	...	...	10,247.24	53
49	...	...	...	...	...	9,607.991	54
50	11,944.83	11,384.33	10,784.07	10,181.51	9,584.430	8,984.582	55
51	...	...	...	...	...	8,377.492	56
52	...	...	...	...	...	7,786.268	57
53	...	...	...	...	...	7,211.717	58
54	...	...	...	...	...	6,654.114	59
55	...	...	...	...	...	6,114.172	60
56	...	...	...	...	...	5,592.223	61
57	...	...	...	...	...	5,089.459	62
58	...	...	...	...	...	4,606.747	63
59	...	...	...	...	...	4,144.999	64
60	5,714.329	5,356.260	4,950.583	4,534.963	4,120.996	3,705.473	65
61	...	...	...	...	...	3,289.074	66
62	...	...	...	...	...	2,897.099	67
63	...	...	...	...	...	2,530.282	68
64	...	...	...	...	...	2,189.712	69
65	...	...	...	...	...	1,876.031	70

Age at Entry (x)	$C_{(x)}$	$C_{(x)+1}$	$C_{(x)+2}$	$C_{(x)+3}$	$C_{(x)+4}$	$C_{(x)+5}$	Age Attained $(x+5)$
15						367.0916	20
16						360.7768	21
17						354.4694	22
18						344.6723	23
19						335.5556	24
20	254.4392	321.3682	326.3657	326.2781	326.2463	326.2525	25
21						315.2198	26
22						304.5602	27
23						293.1548	28
24						282.1725	29
25						271.9420	30
26						261.4155	31
27						252.2540	32
28						245.5866	33
29						239.6815	34
30	182.4421	228.8217	229.4387	225.7161	227.9824	234.4747	35
31						231.8662	36
32						229.9776	37
33						228.4745	38
34						228.0729	39
35						228.9014	40
36						230.5920	41
37						233.7289	42
38						236.3899	43
39						240.9429	44
40	143.9785	193.1031	202.7473	209.7575	223.7175	245.3286	45
41						250.3333	46
42						256.0616	47
43						261.6722	48
44						268.2219	49
45						274.3755	50
46						280.4747	51
47						286.9782	52
48						292.7210	53
49						298.5011	54
50	156.5636	215.2869	237.7220	252.7762	275.7366	303.2642	55
51						307.9267	56
52						311.2472	57
53						313.7283	58
54						314.9240	59
55						315.1895	60
56						313.6550	61
57						310.6045	62
58						305.9636	63
59						299.3577	64
60	164.7080	224.5471	248.2088	260.6111	276.1657	291.0932	65
61						280.7506	66
62						268.8467	67
63						255.0054	68
64						239.6330	69
65						222.8352	70

Age at Entry (x)	$N_{(x)}$	$N_{(x)+1}$	$N_{(x)+2}$	$N_{(x)+3}$	$N_{(x)+4}$	$N_{(x)+5}$	Age Attained $(x+5)$
15						972,468.49	20
16						924,008.58	21
17						877,554.50	22
18						833,032.11	23
19						790,369.77	24
20	972,046.63	923,808.85	877,456.74	832,993.46	790,360.13	749,494.79	25
21						710,337.61	26
22						672,830.84	27
23						636,907.64	28
24						602,503.79	29
25						569,556.51	30
26						538,005.56	31
27						507,793.49	32
28						478,864.50	33
29						451,166.04	34
30	569,169.21	537,808.16	507,690.07	478,819.29	451,153.93	424,649.83	35
31						399,269.99	36
32						374,982.88	37
33						351,748.94	38
34						329,530.66	39
35						308,292.20	40
36						288,000.02	41
37						268,622.95	42
38						250,131.74	43
39						232,499.56	44
40	307,813.94	287,735.19	268,479.41	250,067.89	232,481.73	215,700.03	45
41						199,709.54	46
42						184,505.12	47
43						170,065.20	48
44						156,369.64	49
45						143,398.89	50
46						131,134.99	51
47						119,560.18	52
48						108,657.27	53
49						98,410.030	54
50	142,681.21	130,736.38	119,352.05	108,567.98	98,386.469	88,802.039	55
51						79,817.457	56
52						71,439.965	57
53						63,653.697	58
54						56,441.980	59
55						49,787.866	60
56						43,673.694	61
57						38,081.471	62
58						32,992.012	63
59						28,385.265	64
60	48,917.397	43,203.068	37,846.808	32,896.225	28,361.262	24,240.266	65
61						20,534.793	66
62						17,245.719	67
63						14,348.620	68
64						11,818.338	69
65						9,628.626	70

Age at Entry (x)	$M_{(x)}$	$M_{(x)+1}$	$M_{(x)+2}$	$M_{(x)+3}$	$M_{(x)+4}$	$M_{(x)+5}$	Age Attained $(x+5)$
15						15,574.5087	20
16						15,207.4171	21
17						14,846.6403	22
18						14,492.1709	23
19						14,147.4986	24
20	15,366.6405	15,112.2013	14,790.8331	14,464.4674	14,138.1893	13,811.9430	25
21						13,485.6905	26
22						13,170.4707	27
23						12,865.9105	28
24						12,572.7557	29
25						12,290.5832	30
26						12,018.6412	31
27						11,757.2257	32
28						11,504.9717	33
29						11,259.3851	34
30	12,114.1046	11,931.6625	11,702.8408	11,473.4021	11,247.6860	11,019.7036	35
31						10,785.2289	36
32						10,553.3627	37
33						10,323.3851	38
34						10,094.9106	39
35						9,866.8377	40
36						9,637.9363	41
37						9,407.3443	42
38						9,173.6154	43
39						8,937.2255	44
40	9,669.5865	9,525.6080	9,332.5049	9,129.7576	8,920.0001	8,696.2826	45
41						8,450.9540	46
42						8,200.6207	47
43						7,944.5591	48
44						7,682.8869	49
45						7,414.6650	50
46						7,140.2895	51
47						6,859.8148	52
48						6,572.8366	53
49						6.280.1156	54
50	7,119.6998	6,963.1362	6,747.8493	6,510.1273	6,257.3511	5,981.6145	55
51						5,678.3503	56
52						5,370.4236	57
53						5,059.1764	58
54						4,745.4481	59
55						4,430.5241	60
56						4,115.3346	61
57						3,801.0796	62
58						3,491.0751	63
59						3,185.1115	64
60	4,059.9945	3,895.2865	3,670.7394	3,422.5306	3,161.9195	2,885.7538	65
61						2,594.6606	66
62						2,313.9100	67
63						2,045.0633	68
64						1,790.0579	69
65						1,550.4249	70

Age	D_x	C_x	N_x	M_x
71.....	1,589.755	204.8833	7,752.595	1,327.5897
72.....	1,331.112	186.0240	6,162.840	1,122.7064
73.....	1,100.074	166.6376	4,831.728	936.6824
74.....	896.2359	147.0616	3,731.6542	770.0448
75.....	718.8669	127.7406	2,835.4183	622.9832
76.....	566.8167	108.9923	2,116.5514	495.2426
77.....	438.6568	91.22923	1,549.7347	386.25029
78.....	332.5937	74.74098	1,111.0779	295.02106
79.....	246.6056	59.90149	778.4842	220.28008
80.....	178.3648	46.78143	531.8786	160.37859
81.....	125.5517	35.55213	353.5138	113.59716
82.....	85.75389	26.17956	227.96209	78.04503
83.....	56.67444	18.62325	142.20820	51.86547
84.....	36.13466	12.78343	85.53376	33.24222
85.....	22.12929	8.407076	49.39910	20.458790
86.....	12.97388	5.314904	27.26981	12.051714
87.....	7.220246	3.148927	14.295928	6.736810
88.....	3.827157	1.825465	7.075682	3.587883
89.....	1.872272	.9497030	3.248525	1.7624181
90.....	.8592551	.4806410	1.3762527	.8127151
91.....	.3495571	.2110852	.5169976	.3320741
92.....	.1266511	.0815788	.1674405	.1209889
93.....	.0407894	.0394101	.0407894	.0394101
94.....	....	....	....	....

IMPAIRED LIFE TABLES*

AMERICAN MEN $3\frac{1}{2}$ PER CENT

250 Per Cent q_x

SELECT NET ANNUAL PREMIUMS PER $1,000

Age	Ordinary Life	Twenty-Payment Life	Twenty-Year Endowment
15	$15.96	$23.54	$39.60
20	18.10	25.76	40.06
25	20.70	28.22	40.49
30	24.16	31.30	41.29
35	28.99	35.50	43.11
40	35.66	41.23	46.51
45	44.75	49.03	52.27
50	57.05	59.84	61.50
55	73.61	75.00	75.64
60	95.81	96.26	96.41
65	125.45	125.51	125.53

---

* Calculated by Minnesota Mutual Life Insurance Company, March, 1922.

Age at Entry	$D_{(x)}$	$D_{(x)+1}$	$D_{(x)+2}$	$D_{(x)+3}$	$D_{(x)+4}$	$D_{(x)+5}$	Age Attained $(x+5)$
15	59,425.83	57,061.59	54,685.65	52,385.77	50,164.86	48,017.66	20
16						45,939.38	21
17						43,939.71	22
18						42,016.40	23
19						40,171.18	24
20	47,742.25	45,812.64	43,866.05	41,980.14	40,158.92	38,400.17	25
21						36,701.77	26
22						35,074.72	27
23						33,516.50	28
24						32,025.78	29
25	38,138.24	36,578.30	35,002.03	33,478.34	32,012.87	30,600.04	30
26						29,235.48	31
27						27,930.55	32
28						26,681.73	23
29						25,483.56	34
30	30,369.88	29,121.89	27,860.37	26,641.56	25,468.97	24,333.82	35
31						23,230.09	36
32						22,167.30	37
33						21,143.60	38
34						20,157.00	39
35	24,110.04	23,110.68	22,089.45	21,098.42	20,140.26	19,204.60	40
36						18,284.29	41
37						17,393.90	42
38						16,530.96	43
39						15,694.84	44
40	18,951.78	18,141.05	17,300.06	16,476.75	15,673.93	14,882.74	45
41						14,094.07	46
42						13,327.42	47
43						12,581.16	48
44						11,855.12	49
45	14,578.00	13,915.31	13,212.87	12,516.52	11,831.40	11,147.86	50
46						10,459.14	51
47						9,788.702	52
48						9,135.661	53
49						8,500.613	54
50	10,784.74	10,243.41	9,654.817	9,062.180	8,474.399	7,882.992	55
51						7,283.730	56
52						6,702.754	57
53						6,141.048	58
54						5,599.420	59
55	7,473.081	7,040.915	6,556.672	6,063.814	5,573.013	5,078.769	60
56						4,579.692	61
57						4,103.703	62
58						3,651.921	63
59						3,225.228	64
60	4,661.409	4,335.757	3,961.865	3,579.565	3,201.335	2,824.927	65
61						2,451.936	66
62						2,107.325	67
63						1,791.605	68
64						1,505.258	69
65	2,462.941	2,245.723	1,992.591	1,735.984	1,487.842	1,248.377	70

Age at Entry	$C_{(x)}$	$C_{(x)+1}$	$C_{(x)+2}$	$C_{(x)+3}$	$C_{(x)+4}$	$C_{(x)+5}$	Age Attained $(x+5)$
15	354.6741	446.3202	450.6083	449.4145	450.8016	454.4944	20
16						446.1622	21
17						437.4206	22
18						424.3805	23
19						412.5683	24
20	315.1355	397.3706	402.5176	401.6067	400.7202	399.8432	25
21						385.9270	26
22						372.1130	27
23						357.3170	28
24						342.7398	29
25	270.2417	339.3155	340.0540	333.3483	330.2701	329.7727	30
26						316.2928	31
27						304.3115	32
28						295.8837	33
29						287.9778	34
30	220.9959	276.7146	276.6761	271.6665	273.8789	280.8479	35
31						277.2313	36
32						274.0792	37
33						271.6076	38
34						270.7577	39
35	184.0438	239.7071	244.0469	244.6821	254.5930	270.8748	40
36						272.0891	41
37						274.7339	42
38						277.1088	43
39						281.3482	44
40	169.8458	227.5268	238.2850	245.6342	261.1455	285.3949	45
41						290.0373	46
42						295.5737	47
43						300.5894	48
44						306.3603	49
45	169.7165	231.8710	249.5402	261.8575	283.4415	311.7432	50
46						316.7459	51
47						322.0228	52
48						326.1125	53
49						330.1603	54
50	176.6314	242.1978	266.1452	281.3305	304.8330	332.6875	55
51						334.6662	56
52						335.0429	57
53						333.9604	58
54						331.2985	59
55	179.4532	246.1443	271.1345	285.7450	305.7848	327.3311	60
56						321.1202	61
57						313.0087	62
58						303.1982	63
59						291.2351	64
60	168.0193	227.2725	248.3233	257.1820	268.1501	277.4627	65
61						261.6947	66
62						244.4587	67
63						225.7608	68
64						205.9782	69
65	133.9297	177.1901	189.2241	189.4379	189.1508	185.3627	70

Age at Entry	$N_{(x)}$	$N_{(x)+1}$	$N_{(x)+2}$	$N_{(x)+3}$	$N_{(x)+4}$	$N_{(x)+5}$	Age Attained $(x+5)$
15	1193,840.96	1134,415.13	1077,353.54	1022,667.89	970,282.12	920,117.26	20
16						872,099.60	21
17						826,160.22	22
18						782,220.51	23
19						740,204.11	24
20	919,592.93	871,850.68	826,038.04	782,171.99	740,191.85	700,032.93	25
21						661,632.76	26
22						624,930.99	27
23						589,856.27	28
24						556,339.77	29
25	699,523.77	661,385.53	624,807.23	589,805.20	556,326.86	524,313.99	30
26						493,713.95	31
27						464,478.47	32
28						436,547.92	33
29						409,866.19	34
30	523,845.30	493,475.42	464,353.53	436,493.16	409,851.60	384,382.63	35
31						360,048.81	36
32						336,818.72	37
33						314,651.42	38
34						293,507.82	39
35	383,899.67	359,789.63	336,678.95	314,589.50	293,491.08	273,350.82	40
36						254,146.22	41
37						235,861.93	42
38						218,468.03	43
39						201,937.07	44
40	272,785.80	253,834.02	235,692.97	218,392.91	201,916.16	186,242.23	45
41						171,359.49	46
42						157,265.42	47
43						143,938.00	48
44						131,356.84	49
45	185,555.82	170,977 82	157,062.51	143,849.64	131,333.12	119,501.72	50
46						108,353.86	51
47						97,894.716	52
48						88,106.014	53
49						78,970.353	54
50	118,689.29	107,904.55	97,661.136	88,006.319	78,944.139	70,469.740	55
51						62,586.748	56
52						55,303.018	57
53						48,600 264	58
54						42,459.216	59
55	69,567.291	62,094.210	55,053.295	48,496.623	42,432.809	36,859.796	60
56						31,781.027	61
57						27,201.335	62
58						23,097.632	63
59						19,445.711	64
60	35,960.414	31,299.005	26,963.248	23,001.383	19,421.818	16,220.483	65
61						13,395.556	66
62						10,943.620	67
63						8,836.295	68
64						7,044.690	69
65	15,464.513	13,001.572	10,755.849	8,763.258	7,027.274	5,539.432	70

Age at Entry	$M_{(x)}$	$M_{(x)+1}$	$M_{(x)+2}$	$M_{(x)+3}$	$M_{(x)+4}$	$M_{(x)+5}$	Age Attained $(x+5)$
15	19,054.3995	18,699.7254	18,253.4052	17,802.7969	17,353.3824	16,902.5808	20
16	....	....	....	....	....	16,448.0864	21
17	....	....	....	....	....	16,001.9242	22
18	....	....	....	....	....	15,564.5036	23
19	....	....	....	....	....	15,140.1231	24
20	16,644.9054	16,329.7699	15,932.3993	15,529.8817	15,128.2750	14,727.5548	25
21	....	....	....	....	....	14,327.7116	26
22	....	....	....	....	....	13,941.7846	27
23	....	....	....	....	....	13,569.6716	28
24	....	....	....	....	....	13,212.3546	29
25	14,482.8444	14,212.6027	13,873.2872	13,533.2332	13,199.8849	12,869.6148	30
26	....	....	....	....	....	12,539.8421	31
27	....	....	....	....	....	12,223.5493	32
28	....	....	....	....	....	11,919.2378	33
29	....	....	....	....	....	11,623.3541	34
30	12,655.3083	12,434.3124	12,157.5978	11,880.9217	11,609.2552	11,335.3763	35
31	....	....	....	....	....	11,054.5284	36
32	....	....	....	....	....	10,777.2971	37
33	....	....	....	....	....	10,503.2179	38
34	....	....	....	....	....	10,231.6103	39
35	11,127.9255	10,943.8817	10,704.1746	10,460.1277	10,215.4456	9,960.8526	40
36	....	....	....	....	....	9,689.9778	41
37	....	....	....	....	....	9,417.8887	42
38	....	....	....	....	....	9,143.1548	43
39	....	....	....	....	....	8,866.0460	44
40	9,727.1351	9,557.2893	9,329.7625	9,091.4775	8,845.8433	8,584.6978	45
41	....	....	....	....	....	8,299.3029	46
42	....	....	....	....	....	8,009.2656	47
43	....	....	....	....	....	7,713.6919	48
44	....	....	....	....	....	7,413.1025	49
45	8,303.1689	8,133.4524	7,901.5814	7,652.0412	7,390.1837	7,106.7422	50
46	....	....	....	....	....	6,794.9990	51
47	....	....	....	....	....	6,478.2531	52
48	....	....	....	....	....	6,156.2303	53
49	....	....	....	....	....	5,830.1178	54
50	6,771.0954	6,594.4640	6,352.2662	6,086.1210	5,804.7905	5,499.9575	55
51	....	....	....	....	....	5,167.2700	56
52	....	....	....	....	....	4,832.6038	57
53	....	....	....	....	....	4,497.5609	58
54	....	....	....	....	....	4,163.6005	59
55	5,120.5638	4,941.1106	4,694.9663	4,423.8318	4,138.0868	3,832.3020	60
56	....	....	....	....	....	3,504.9709	61
57	....	....	....	....	....	3,183.8507	62
58	....	....	....	....	....	2,870.8420	63
59	....	....	....	....	....	2,567.6438	64
60	3,445.3559	3,277.3366	3,050.0641	2,801.7408	2,544.5588	2,276.4087	65
61	....	....	....	....	....	1,998.9460	66
62	....	....	....	....	....	1,737.2513	67
63	....	....	....	....	....	1,492.7926	68
64	....	....	....	....	....	1,267.0318	69
65	1,939.9862	1,806.0565	1,628.8664	1,439.6423	1,250.2044	1,061.0536	70

Age	D_x	C_x	N_x	M_x
71.........	1020.799	164.4779	4291.055	875.6909
72.........	821.8013	143.5761	3270.2560	711.2130
73.........	650.4348	123.1942	2448.4547	567.6369
74.........	505.2452	103.6478	1798.0199	444.4427
75.........	384.5119	85.35558	1292.7747	340.79490
76.........	286.1535	68.74788	908.2628	255.43932
77.........	207.7289	53.98584	622.1093	186.69144
78.........	146.7185	41.19997	414.3804	132.70560
79.........	100.5570	30.55678	267.6619	91.50563
80.........	66.59974	21.81901	167.10488	60.94885
81.........	42.52857	15.06648	100.50514	39.12984
82.........	26.02392	9.896450	57.97657	24.063362
83.........	15.24744	6.281871	31.95265	14.166912
84.........	8.449951	3.759831	16.705205	7.885041
85.........	4.404373	2.075821	8.255254	4.125210
86.........	2.179612	1.103093	3.850881	2.049389
87.........	1.002812	.5328953	1.671269	.9462958
88.........	.4360053	.2340340	.6684565	.4134005
89.........	.1872272	.1356719	.2324512	.1793665
90.........	.0452240	.0436946	.0452240	.0436946

Age at Entry	$q_{(x)}$	$q_{(x)+1}$	$q_{(x)+2}$	$q_{(x)+3}$	$q_{(x)+4}$	$q_{(x)+5}$	Age Attained $(x+5)$
15	.00618	.00810	.00853	.00888	.00930	.00980	20
16						.01005	21
17						.01030	22
18						.01045	23
19						.01063	24
20	.00683	.00898	.00950	.00990	.01033	.01078	25
21						.01088	26
22						.01098	27
23						.01103	28
24						.01108	29
25	.00733	.00960	.01005	.01030	.01068	.01115	30
26						.01120	31
27						.01128	32
28						.01148	33
29						.01170	34
30	.00753	.00983	.01028	.01055	.01113	.01195	35
31						.01235	36
32						.01280	37
33						.01330	38
34						.01390	39
35	.00790	.01073	.01143	.01200	.01308	.01460	40
36						.01540	41
37						.01635	42
38						.01735	43
39						.01855	44
40	.00928	.01298	.01425	.01543	.01725	.01985	45
41						.02130	46
42						.02295	47
43						.02473	48
44						.02675	49
45	.01205	.01725	.01955	.02165	.02480	.02895	50
46						.03135	51
47						.03405	52
48						.03695	53
49						.04020	54
50	.01695	.02448	.02853	.03213	.03723	.04368	55
51						.04755	56
52						.05173	57
53						.05628	58
54						.06123	59
55	.02485	.03618	.04280	.04878	.05678	.06670	60
56						.07258	61
57						.07895	62
58						.08593	63
59						.09345	64
60	.03730	.05425	.06488	.07435	.08670	.10165	65
61						.11045	66
62						.12008	67
63						.13040	68
64						.14160	69
65	.05630	.08168	.09828	.11293	.13158	.15368	70

Age at Entry	$l_{(x)}$	$l_{(x)+1}$	$l_{(x)+2}$	$l_{(x)+3}$	$l_{(x)+4}$	$l_{(x)+5}$	Age Attained $(x+5)$
15	99559	98944	98143	97306	96442	95545	20
16	....	....	....	....	....	94609	21
17	....	....	....	....	....	93658	22
18	....	....	....	....	....	92693	23
19	....	....	....	....	....	91724	24
20	94997	94348	93501	92613	91696	90749	25
21	....	....	....	....	....	89771	26
22	....	....	....	....	....	88794	27
23	....	....	....	....	....	87819	28
24	....	....	....	....	....	86850	29
25	90130	89469	88610	87719	86815	85888	30
26	....	....	....	....	....	84930	31
27	....	....	....	....	....	83979	32
28	....	....	....	....	....	83032	33
29	....	....	....	....	....	82079	34
30	85242	84600	83768	82907	82032	81119	35
31	....	....	....	....	....	80150	36
32	....	....	....	....	....	79160	37
33	....	....	....	....	....	78147	38
34	....	....	....	....	....	77108	39
35	80373	79738	78882	77980	77044	76036	40
36	....	....	....	....	....	74926	41
37	....	....	....	....	....	73772	42
38	....	....	....	....	....	72566	43
39	....	....	....	....	....	71307	44
40	75035	74339	73374	72328	71212	69984	45
41	....	....	....	....	....	68595	46
42	....	....	....	....	....	67134	47
43	....	....	....	....	....	65593	48
44	....	....	....	....	....	63971	49
45	68551	67725	66557	65256	63843	62260	50
46	....	....	....	....	....	60458	51
47	....	....	....	....	....	58563	52
48	....	....	....	....	....	56569	53
49	....	....	....	....	....	54479	54
50	60232	59211	57762	56114	54311	52289	55
51	....	....	....	....	....	50005	56
52	....	....	....	....	....	47627	57
53	....	....	....	....	....	45163	58
54	....	....	....	....	....	42621	59
55	49570	48338	46589	44595	42420	40011	60
56	....	....	....	....	....	37342	61
57	....	....	....	....	....	34632	62
58	....	....	....	....	....	31898	63
59	....	....	....	....	....	29157	64
60	36723	35353	33435	31266	28941	26432	65
61	....	....	....	....	....	23745	66
62	....	....	....	....	....	21122	67
63	....	....	....	....	....	18586	68
64	....	....	....	....	....	16162	69
65	23045	21748	19972	18009	15975	13873	70

Age at Entry	$d_{(x)}$	$d_{(x)+1}$	$d_{(x)+2}$	$d_{(x)+3}$	$d_{(x)+4}$	$d_{(x)+5}$	Age Attained $(x+5)$
15	615	801	837	864	897	936	20
16						951	21
17						965	22
18						969	23
19						975	24
20	649	847	888	917	947	978	25
21						977	26
22						975	27
23						969	28
24						962	29
25	661	859	891	904	927	958	30
26						951	31
27						947	32
28						953	33
29						960	34
30	642	832	861	875	913	969	35
31						990	36
32						1013	37
33						1039	38
34						1072	39
35	635	856	902	936	1008	1110	40
36						1154	41
37						1206	42
38						1259	43
39						1323	44
40	696	965	1046	1116	1228	1389	45
41						1461	46
42						1541	47
43						1622	48
44						1711	49
45	826	1168	1301	1413	1583	1802	50
46						1895	51
47						1994	52
48						2090	53
49						2190	54
50	1021	1449	1648	1803	2022	2284	55
51						2378	56
52						2464	57
53						2542	58
54						2610	59
55	1232	1749	1994	2175	2409	2669	60
56						2710	61
57						2734	62
58						2741	63
59						2725	64
60	1370	1918	2169	2325	2509	2687	65
61						2623	66
62						2536	67
63						2424	68
64						2289	69
65	1297	1776	1963	2034	2102	2132	70

Age	q_x	l_x	d_x
71	.16675	11741	1958
72	.18083	9783	1769
73	.19598	8014	1571
74	.21230	6443	1368
75	.22985	5075	1166
76	.24878	3909	972
77	.26913	2937	790
78	.29078	2147	624
79	.31423	1523	479
80	.33935	1044	354
81	.36605	690	253
82	.39468	437	172
83	.42513	265	113
84	.45788	152	70
85	.49268	82	40
86	.52950	42	22
87	.56823	20	11
88	.61020	9	5
89	.65425	4	3
90	.70088	1	1
91	.74865	....	....
92	.80270	....	....
93	.85470	....	....
94	.90910	....	....
95	.96940	....	....
96	1.00000	....	....

IMPAIRED LIFE TABLES*

AMERICAN MEN 3½ PER CENT

$(q^{x}=q_{x}+.010)$

COMPARISON OF STANDARD NET LEVEL PREMIUMS AND SUBSTANDARD NET LEVEL PREMIUMS WHERE THE MORTALITY HAS BEEN INCREASED BY 10 PER 1,000

ULTIMATE AND SELECT AND ULTIMATE PREMIUMS

Age	Ordinary Life Select and Ultimate		Twenty-Payment Life Select and Ultimate	
	Standard	Substandard 10 Additional Deaths per Year	Standard	Substandard 10 Additional Deaths per Year
20	....	$18.59	....	$27.05
30	....	22.23	....	30.44
40	....	28.84	....	36.31
50	....	40.58	....	46.36
60	....	61.01	....	64.08

Age	Ordinary Life Ultimate			Twenty-Payment Life Ultimate		
	Standard	Substandard 10 Additional Deaths per Year	Extra	Standard	Substandard 10 Additional Deaths per Year	Extra
20	$10.72	$18.70	$7.98	$16.96	$27.21	$10.25
30	14.74	22.38	7.64	21.54	30.65	9.11
40	21.75	29.12	7.37	28.64	36.66	8.02
50	34.15	41.40	7.25	40.00	47.27	7.27
60	56.23	63.53	7.30	59.61	66.71	7.10

NET ANNUAL PREMIUMS PER $1,000 ON BASIS OF AN EXTRA MORTALITY OF 10 PER 1,000

Age	Select		Ultimate	
	Ordinary Life	Twenty-Payment Life	Ordinary Life	Twenty-Payment Life
20	$18.59	$27.05	$18.70	$27.21
30	22.23	30.44	22.38	30.65
40	28.84	36.31	29.12	36.66
50	40.58	46.35	41.40	47.27
60	61.01	64.08	63.53	66.71

---

* Computed by the International Life Insurance Company, St. Louis, Missouri.

Age	l_x	d_x	q'_x
66	33806	1832	.05418
67	31974	1855	.05803
68	30119	1872	.06216
69	28247	1882	.06664
70	26365	1884	.07147
71	24481	1878	.07670
72	22603	1861	.08233
73	20742	1833	.08839
74	18909	1795	.09492
75	17114	1745	.10194
76	15369	1683	.10951
77	13686	1610	.11765
78	12076	1525	.12631
79	10551	1432	.13569
80	9119	1329	.14574
81	7790	1219	.15642
82	6571	1103	.16787
83	5468	985	.18005
84	4483	866	.19315
85	3617	749	.20707
86	2868	636	.22180
87	2232	530	.23729
88	1702	432	.25408
89	1270	345	.27170
90	925	269	.29035
91	656	203	.30946
92	453	150	.33108
93	303	107	.35188
94	196	73	.37364
95	123	49	.39776
96	74	31	.42111
97	43	20	.45340
98	23	11	.46763
99	12	6	.51000
100	6	3	.57250
101	3	2	.58143
102	1	1	.67667

Age (x)	$l_{(x)}$	$l_{(x)+1}$	$l_{(x)+2}$	$l_{(x)+3}$	$l_{(x)+4}$	$l_{(x)+5}$	Age Attained $(x)+5$
15						93370	20
16						92070	21
17						90779	22
18						89497	23
19						88228	24
20	93155	91969	90719	89467	88218	86971	25
21						85726	26
22						84496	27
23						83280	28
24						82080	29
25						80896	30
26						79726	31
27						78572	32
28						77432	33
29						76302	34
30	80650	79601	78492	77384	76284	75182	35
31						74071	36
32						72964	37
33						71861	38
34						70760	39
35						69659	40
36						68556	41
37						67448	42
38						66332	43
39						65208	44
40	69289	68339	67301	66244	65173	64072	45
41						62923	46
42						61758	47
43						60573	48
44						59368	49
45						58139	50
46						56884	51
47						55602	52
48						54289	53
49						52944	54
50	57379	56416	55300	54116	52879	51563	55
51						50147	56
52						48692	57
53						47198	58
54						45664	59
55						44089	60
56						42472	61
57						40814	62
58						39117	63
59						37381	64
60	42647	41584	40266	38818	37275	35610	65

Age (x)	$d_{(x)}$	$d_{(x)+1}$	$d_{(x)+2}$	$d_{(x)+3}$	$d_{(x)+4}$	$d_{(x)+5}$	Age Attained ($x+5$)
15						1300	20
16						1291	21
17						1282	22
18						1269	23
19						1257	24
20	1186	1250	1252	1249	1247	1245	25
21						1230	26
22						1216	27
23						1200	28
24						1184	29
25						1170	30
26						1154	31
27						1140	32
28						1130	33
29						1120	34
30	1049	1109	1108	1100	1102	1111	35
31						1107	36
32						1103	37
33						1101	38
34						1101	39
35						1103	40
36						1108	41
37						1116	42
38						1124	43
39						1136	44
40	950	1038	1057	1071	1101	1149	45
41						1165	46
42						1185	47
43						1205	48
44						1229	49
45						1255	50
46						1282	51
47						1313	52
48						1345	53
49						1381	54
50	963	1116	1184	1237	1316	1416	55
51						1455	56
52						1494	57
53						1534	58
54						1575	59
55						1617	60
56						1658	61
57						1697	62
58						1736	63
59						1771	64
60	1063	1318	1448	1543	1665	1804	65

Age (x)	$q'_{(x)}$	$q'_{(x)+1}$	$q'_{(x)+2}$	$q'_{(x)+3}$	$q'_{(x)+4}$	$q'_{(x)+5}$	Age Attained ($x+5$)
15						.01392	20
16						.01402	21
17						.01412	22
18						.01418	23
19						.01425	24
20	.01273	.01359	.01380	.01396	.01413	.01431	25
21						.01435	26
22						.01439	27
23						.01441	28
24						.01443	29
25						.01446	30
26						.01448	31
27						.01451	32
28						.01459	33
29						.01468	34
30	.01301	.01393	.01411	.01422	.01445	.01478	35
31						.01494	36
32						.01512	37
33						.01532	38
34						.01556	39
35						.01584	40
36						.01616	41
37						.01654	42
38						.01694	43
39						.01742	44
40	.01371	.01519	.01570	.01617	.01690	.01794	45
41						.01852	46
42						.01918	47
43						.01989	48
44						.02070	49
45						.02158	50
46						.02254	51
47						.02362	52
48						.02478	53
49						.02608	54
50	.01678	.01979	.02141	.02285	.02489	.02747	55
51						.02902	56
52						.03069	57
53						.03251	58
54						.03449	59
55						.03668	60
56						.03903	61
57						.04158	62
58						.04437	63
59						.04738	64
60	.02492	.03170	.03595	.03974	.04468	.05066	65

Age	D_x	N_x	C_x	M_x
66	3,490.8414	29,426.5901	182.7768	2,495.7466
67	3,190.0140	25,935.7487	178.8127	2,312.9698
68	2,903.3210	22,745.7347	174.3506	2,134.1570
69	2,630.8126	19,842.4137	169.3537	1,959.8065
70	2,372.4809	17,211.6011	163.8006	1,790.4528
71	2,128.4516	14,839.1202	157.7576	1,626.6522
72	1,898.7198	12,710.6687	151.0425	1,468.8946
73	1,683.4622	10,811.9488	143.7402	1,317.8521
74	1,482.8060	9,128.4866	136.0000	1,174.1119
75	1,296.6593	7,645.6807	127.7410	1,038.1119
76	1,125.0723	6,349.0214	119.0352	910.37094
77	967.9834	5,223.9491	110.0226	791.33572
78	825.2376	4,255.9657	100.6897	681.31315
79	696.6403	3,430.7281	91.35157	580.62350
80	581.7284	2,734.0877	81.91424	489.27193
81	480.1444	2,152.3594	72.59266	407.35769
82	391.3096	1,672.2149	63.46441	334.76503
83	314.6178	1,280.9053	54.75812	271.30062
84	249.2189	966.2875	46.51459	216.54250
85	194.2763	717.0686	38.87010	170.02791
86	148.8377	522.7923	31.88967	131.15781
87	111.9147	373.9546	25.67585	99.26814
88	82.45339	262.0398	20.22062	73.59229
89	59.44489	179.5865	15.60228	53.37167
90	41.83220	120.1416	11.75395	37.76939
91	28.66392	78.30937	8.57005	26.01544
92	19.12430	49.64545	6.11835	17.44539
93	12.35907	30.52114	4.21687	11.32704
94	7.724360	18.16208	2.77962	7.11017
95	4.683471	10.43772	1.80271	4.33055
96	2.722460	5.754246	1.10192	2.52784
97	1.528478	3.031786	.68688	1.42592
98	.789912	1.503308	.36500	.73904
99	.398184	.713396	.19236	.37404
100	.192360	.315212	.09292	.18168
101	.092925	.122852	.05985	.08876
102	.029927	.029927	.02891	.02891

Age (x)	$D_{(x)}$	$D_{(x)+1}$	$D_{(x)+2}$	$D_{(x)+3}$	$D_{(x)+4}$	$D_{(x)+5}$	Age Attained $(x+5)$
15	....	....	....	....	....	46,924.587	20
16	....	....	....	....	....	44,706.522	21
17	....	....	....	....	....	42,589.059	22
18	....	....	....	....	....	40,567.737	23
19	....	....	....	....	....	38,640.070	24
20	46,816.536	44,657.479	42,560.910	40,554.139	38,635.691	36,801.518	25
21	....	....	....	....	....	35,048.046	26
22	....	....	....	....	....	33,376.934	27
23	....	....	....	....	....	31,784.145	28
24	....	....	....	....	....	30,266.836	29
25	....	....	....	....	....	28,821.465	30
26	....	....	....	....	....	27,444.081	31
27	....	....	....	....	....	26,132.261	32
28	....	....	....	....	....	24,882.231	33
29	....	....	....	....	....	23,689.940	34
30	28,733.821	27,401.052	26,105.654	24,866.807	23,684.351	22,552.871	35
31	....	....	....	....	....	21,468.220	36
32	....	....	....	....	....	20,432.255	37
33	....	....	....	....	....	19,442.856	38
34	....	....	....	....	....	18,497.584	39
35	....	....	....	....	....	17,593.913	40
36	....	....	....	....	....	16,729.789	41
37	....	....	....	....	....	15,902.822	42
38	....	....	....	....	....	15,110.828	43
39	....	....	....	....	....	14,352.411	44
40	17,500.461	16,676.835	15,868.162	15,090.781	14,344.708	13,625.487	45
41	....	....	....	....	....	12,928.663	46
42	....	....	....	....	....	12,260.198	47
43	....	....	....	....	....	11,618.265	48
44	....	....	....	....	....	11,002.078	49
45	....	....	....	....	....	10,409.962	50
46	....	....	....	....	....	9,840.8182	51
47	....	....	....	....	....	9,293.7631	52
48	....	....	....	....	....	8,767.4563	53
49	....	....	....	....	....	8,261.1170	54
50	10,273.8821	9,759.8552	9,243.2844	8,739.5175	8,250.9748	7,773.5348	55
51	....	....	....	....	....	7,304.4120	56
52	....	....	....	....	....	6,852.6199	57
53	....	....	....	....	....	6,417.7481	58
54	....	....	....	....	....	5,999.1993	59
55	....	....	....	....	....	5,596.3931	60
56	....	....	....	....	....	5,208.8510	61
57	....	....	....	....	....	4,836.2549	62
58	....	....	....	....	....	4,478.3880	63
59	....	....	....	....	....	4,134.9367	64
60	5,413.3543	5,099.9449	4,771.3197	4,444.1564	4,123.2114	3,805.8188	65

Age (x)	$N_{(x)}$	$N_{(x)+1}$	$N_{(x)+2}$	$N_{(x)+3}$	$N_{(x)+4}$	$N_{(x)+5}$	Age Attained $(x+5)$
15						893,601.536	20
16						846,676.949	21
17						801,970.427	22
18						759,381.368	23
19						718,813.631	24
20	893,398.315	846,581.779	801,924.300	759,363.390	718,809.252	680,173.561	25
21						643,372.043	26
22						608,323.997	27
23						574,947.063	28
24						543,162.918	29
25						512,896.082	30
26						484,074.617	31
27						456,630.536	32
28						430,498.274	33
29						405,616.043	34
30	512,717.789	483,983.968	456,582.916	430,477.261	405,610.455	381,926.103	35
31						359,373.233	36
32						337,905.013	37
33						317,472.758	30
34						298,029.902	38
35						279,532.318	42
36						261,938.405	41
37						245,208.616	49
38						229,305.794	43
39						214,194.966	44
40	279,323.501	261,823.040	245,146.206	229,278.043	214,187.263	199,842.555	45
41						186,217.067	46
42						173,288.405	47
43						161,028.206	48
44						149,409.942	49
45						138,407.864	50
46						127,997.901	51
47						118,157.083	52
48						108,863.320	53
49						100,095.864	54
50	138,102.2606	127,828.3785	118,068.5234	108,825.2390	100,085.7214	91,834.7467	55
51						84,061.2119	56
52						76,756.7999	57
53						69,904.1800	58
54						63,486.4319	59
55						57,487.2326	60
56						51,890.8395	61
57						46,681.9885	62
58						41,845.7335	63
59						37,367.3455	64
60	57,084.3955	51,671.0412	46,571.0963	41,799.7766	37,355.6203	33,232.4089	65

Age (x)	$C_{(x)}$	$C_{(x)+1}$	$C_{(x)+2}$	$C_{(x)+3}$	$C_{(x)+4}$	$C_{(x)+5}$	Age Attained ($x+5$)
15						631.2423	20
16						605.6739	21
17						581.1127	22
18						555.7674	23
19						531.8958	24
20	575.8872	586.4388	567.5141	547.0083	527.6643	509.0033	25
21						485.8648	26
22						464.0913	27
23						442.4976	28
24						421.8332	29
25						402.7491	30
26						383.8089	31
27						366.3310	32
28						350.8379	33
29						335.9742	34
30	361.0973	368.8423	356.0480	341.5236	330.5747	322.0045	35
31						309.9954	36
32						298.4299	37
33						287.8157	38
34						278.0818	39
35						269.1662	40
36						261.2431	41
37						254.2315	42
38						247.3946	43
39						241.5806	44
40	231.8295	244.7386	240.7909	235.7292	234.1376	236.0827	45
41						231.2758	46
42						227.2901	47
43						223.3106	48
44						220.0561	49
45						217.1125	50
46						214.2837	51
47						212.0442	52
48						209.8671	53
49						208.1968	54
50	166.5971	186.5372	191.2113	193.0153	198.3975	206.2546	55
51						204.7680	56
52						203.1467	57
53						201.5323	58
54						199.9211	59
55						198.3121	60
56						196.4647	61
57						194.2844	62
58						192.0294	63
59						189.2756	64
60	130.3684	156.1764	165.7772	170.6805	177.9469	186.2828	65

Age (x)	$M_{(x)}$	$M_{(x)+1}$	$M_{(x)+2}$	$M_{(x)+3}$	$M_{(x)+4}$	$M_{(x)+5}$	Age Attained ($x+5$)
15						16,706.1645	20
16						16,074.9222	21
17						15,469.2482	22
18						14,888.1356	23
19						14,332.3681	24
20	16,604.9850	16,029.0978	15,442.6590	14,875.1450	14,328.1367	13,800.4724	25
21						13,291.4691	26
22						12,805.6043	27
23						12,341.5130	28
24						11,899.0154	29
25						11,477.1823	30
26						11,074.4332	31
27						10,690.6243	32
28						10,324.2933	33
29						9,973.4554	34
30	11,395.5671	11,034.4698	10,665.6275	10,309.5794	9,968.0558	9,637.4812	35
31						9,315.4767	36
32						9,005.4813	37
33						8,707.0514	38
34						8,419.2357	39
35						8,141.1539	40
36						7,871.9878	41
37						7,610.7446	42
38						7,356.5131	43
39						7,109.1185	44
40	8,054.7637	7,822.9342	7,578.1956	7,337.4047	7,101.6754	6,867.5379	45
41						6,631.4551	46
42						6,400.1793	47
43						6,172.8892	48
44						5,949.5786	49
45						5,729.5225	50
46						5,512.4100	51
47						5,298.1263	52
48						5,086.0820	53
49						4,876.2150	54
50	5,603.7765	5,437.1794	5,250.6423	5,059.4310	4,866.4157	4,668.0182	55
51						4,461.7636	56
52						4,256.9957	57
53						4,053.8490	58
54						3,852.3167	59
55						3,652.3956	60
56						3,454.0835	61
57						3,257.6188	62
58						3,063.3344	63
59						2,871.3050	64
60	3,482.9788	3,352.6103	3,196.4339	3,030.6568	2,859.9763	2,682.0294	65

IMPAIRED LIFE TABLES*

AMERICAN MEN $3\frac{1}{2}$ PER CENT

$$q'_x = q_x + .020$$

Age (x)	D_x	$D_{(x)+1}$	$D_{(x)+2}$	$D_{(x)+3}$	$D_{(x)+4}$	$D_{(x)+5}$	Age Attained $(x+5)$
15	59,582.81	56,274.39	53,107.65	50.110.65	47,275.91	44,593.68	20
16						42,055.30	21
17						39,657.30	22
18						37,391.98	23
19						35,253.79	24
20	44,489.65	42,008.20	39,630.09	37,378.84	35,249.42	33,235.66	25
21						31,331.28	26
22						29,534.67	27
23						27,839.77	28
24						26,241.59	29
25	33,142.99	31,287.94	29,509.39	27,826.80	26,237.17	24,734.63	30
26						23,313.69	31
27						21,973.87	32
28						20,710.54	33
29						19,518.08	34
30	24,658.74	23,276.52	21,951.25	20,697.68	19,513.42	18,392.48	35
31						17,330.26	36
32						16,326.68	37
33						15,378.20	38
34						14,481.99	39
35	18,323.19	17,293.45	16,302.88	15,364.67	14,477.02	13,634.62	40
36						12,833.12	41
37						12,074.72	42
38						11,356.81	43
39						10,677.16	44
40	13,561.37	12,792.13	12,048.31	11,341.77	10,671.44	10,033.26	45
41						9,423.169	46
42						8,844.847	47
43						8,296.398	48
44						7,776.221	49
45	9,949.686	9,374.678	8,814.076	8,279.136	7,769.920	7,282.639	50
46						6,814.234	51
47						6,369.516	52
48						5,947.248	53
49						5,546.253	54
50	7,186.666	6,757.664	6,334.582	5,928.191	5,539.543	5,165.425	55
51						4,803.721	56
52						4,460.151	57
53						4,133.918	58
54						3,824.384	59
55	5,056.879	4,739.631	4,421.450	4,113.386	3,817.290	3,530.678	60
56						3,252.093	61
57						2,988.076	62
58						2,738.083	63
59						2,501.689	64
60	3,413.898	3,183.291	2,947.432	2,716.903	2,494.499	2,278.368	65
61						2,067.804	66
62						1,869.675	67
63						1,683.546	68
64						1,509.262	69
65	2,161.8736	1,999.9610	1,830.5653	1,663.7846	1,502.7429	1,346.4620	70

---

* Calculated by North American Life Insurance Company.

Age (x)	C_x	$C_{(x)+1}$	$C_{(x)+2}$	$C_{(x)+3}$	$C_{(x)+4}$	$C_{(x)+5}$	Age Attained $(x+5)$
15	1293.551	1263.738	1201.084	1140.181	1083.532	1030.381	20
16						975.8332	21
17						924.2493	22
18						873.7244	23
19						825.9829	24
20	976.9687	957.5364	911.1041	865.4032	821.7515	780.4712	25
21						737.0928	26
22						696.1374	27
23						656.7405	28
24						619.5681	29
25	734.2725	720.5023	684.6878	648.6281	615.2928	584.5032	30
26						551.4337	31
27						520.2538	32
28						492.1046	33
29						465.5641	34
30	548.3590	538.1301	511.2562	484.3427	461.0645	440.2559	35
31						417.5271	36
32						396.3732	37
33						376.1726	38
34						357.6427	39
35	410.1133	405.7658	386.9035	368.0688	352.8438	340.4238	40
36						324.4320	41
37						309.5882	42
38						295.5974	43
39						282.8367	44
40	310.6520	311.2284	299.1091	286.7933	277.3076	270.8067	45
41						259.6638	46
42						249.3485	47
43						239.6190	48
44						230.6208	49
45	238.5482	243.5837	236.8810	229.2411	224.5330	222.1299	50
46						214.2840	51
47						206.8762	52
48						199.8805	53
49						193.2719	54
50	185.9733	194.5605	192.1801	188.1778	186.7893	187.0274	55
51						181.1250	56
52						175.4080	57
53						169.7391	58
54						164.3799	59
55	146.2426	157.9039	158.5471	156.9955	157.5255	159.1891	60
56						154.0429	61
57						148.9482	62
58						143.8007	63
59						138.7241	64
60	115.1607	128.2110	130.8592	130.5268	131.7772	133.5166	65
61						128.2034	66
62						122.9041	67
63						117.3509	68
64						111.7627	69
65	88.8045	101.7646	104.8782	104.7776	105.4637	105.9836	70

Age (x)	N_x	$N_{(x)+1}$	$N_{(x)+2}$	$N_{(x)+3}$	$N_{(x)+4}$	$N_{(x)+5}$	Age Attained $(x+5)$
15	998,615.55	939,032.74	882,758.35	829,650.70	779,540.05	732,264.14	20
16						687,670.46	21
17						645,615.16	22
18						605,957.86	23
19						568,565.88	24
20	732,068.29	687,578.64	645,570.44	605,940.35	568,561.51	533,312.09	25
21						500,076.43	26
22						468,745.15	27
23						439,210.48	28
24						411,370.71	29
25	533,133.41	499,990.42	468,702.48	439,193.09	411,366.29	385,129.12	30
26						360,394.49	31
27						337,080.80	32
28						315,106.93	33
29						294,396.39	34
30	384,975.92	360,317.18	337,040.66	315,089.41	294,391.73	274,878.31	35
31						256,485.83	36
32						239,155.57	37
33						222,828.89	38
34						207,450.69	39
35	274,729.91	256,406.72	239,113.27	222,810.39	207,445.72	192,968.70	40
36						179,334.08	41
37						166,500.96	42
38						154,426.24	43
39						143,069.43	44
40	192,807.29	179,245.92	166,453.79	154,405.48	143,063.71	132,392.27	45
41						122,359.01	46
42						112,935.84	47
43						104,090.99	48
44						95,794.592	49
45	132,205.867	122,256.181	112,881.503	104,067.427	95,788.291	88,018.371	50
46						80,735.732	51
47						73,921.498	52
48						67,551.982	53
49						61,604.734	54
50	87,805.127	80,618.461	73,860.797	67,526.215	61,598.024	56,058.481	55
51						50,893.056	56
52						46,089.335	57
53						41,629.184	58
54						37,495.266	59
55	55,819.518	50,762.639	46,023.008	41,601.558	37,488.172	33,670.882	60
56						30,140.204	61
57						26,888.111	62
58						23,900.035	63
59						21,161.952	64
60	33,416.286	30,002.388	26,819.097	23,871.665	21,154.762	18,660.263	65
61						16,381.895	66
62						14,314.091	67
63						12,444.416	68
64						10,760.870	69
65	18,410.5352	16,248.6616	14,248.7006	12,418.1353	10,754.3507	9,251.6078	70

Age (x)	$M_{(x)}$	$M_{(x)+1}$	$M_{(x)+2}$	$M_{(x)+3}$	$M_{(x)+4}$	$M_{(x)+5}$	Age Attained $(x+5)$
15	25813.2048	24519.6538	23255.9158	22054.8318	20914.6508	19831.1188	20
16						18800.7378	21
17						17824.9046	22
18						16900.6553	23
19						16026.9309	24
20	19733.7119	18756.7432	17799.2068	16888.1027	16022.6995	15200.9480	25
21						14420.4768	26
22						13683.3840	27
23						12987.2466	28
24						12330.5061	29
25	15114.3215	14380.0490	13659.5467	12974.8589	12326.2308	11710.9380	30
26						11126.4348	31
27						10575.0011	32
28						10054.7473	33
29						9562.6427	34
30	11640.2311	11091.8721	10553.7420	10042.4858	9558.1431	9097.0786	35
31						8656.8227	36
32						8239.2956	37
33						7842.9224	38
34						7466.7498	39
35	9032.8023	8622.6890	8216.9232	7830.0197	7461.9509	7109.1071	40
36						6768.6833	41
37						6444.2513	42
38						6134.6631	43
39						5839.0657	44
40	7041.3194	6730.6674	6419.4390	6120.3299	5833.5366	5556.2290	45
41						5285.4223	46
42						5025.7585	47
43						4776.4100	48
44						4536.7910	49
45	5478.9572	5240.4090	4996.8253	4759.9443	4530.7032	4306.1702	50
46						4084.0403	51
47						3869.7563	52
48						3662.8801	53
49						3462.9996	54
50	4217.4087	4031.4354	3836.8749	3644.6948	3456.5170	3269.7277	55
51						3082.7003	56
52						2901.5753	57
53						2726.1673	58
54						2556.4282	59
55	3169.2629	3023.0203	2865.1164	2706.5693	2549.5738	2392.0483	60
56						2232.8592	61
57						2078.8163	62
58						1929.8681	63
59						1786.0674	64
60	2283.8782	2168.7175	2040.5065	1909.6473	1779.1205	1647.3433	65
61						1513.8267	66
62						1385.6233	67
63						1262.7192	68
64						1145.3683	69
65	1539.2942	1450.4897	1348.7251	1243.8469	1139.0693	1033.6056	70

Age x	D_x	N_x	C_x	M_x
71........	1194.946	7905.1458	100.1316	927.62196
72........	1054.406	6710.1998	94.06711	827.49036
73........	924.6821	5655.7938	87.90624	733.42325
74........	805.5066	4731.1117	81.67564	645.51701
75........	696.5917	3925.6051	75.32671	563.84137
76........	597.7090	3229.0134	69.03082	488.51466
77........	508.4657	2631.3044	62.73291	419.48384
78........	428.5382	2122.8387	56.45189	356.75093
79........	357.5946	1694.3005	50.33260	300.29904
80........	295.1697	1336.7059	44.43927	249.96644
81........	240.7487	1041.5362	38.70835	205.52717
82........	193.8990	800.78751	33.31421	166.81882
83........	154.0279	606.88851	28.29623	133.50461
84........	120.5230	452.86061	23.63324	105.20838
85........	92.81416	332.33761	19.46081	81.575140
86........	70.21461	239.52345	15.74415	62.114330
87........	52.09608	169.30884	12.45037	46.370180
88........	37.88399	117.21276	9.689008	33.919810
89........	26.91391	79.328772	7.326288	24.230802
90........	18.67751	52.414862	5.418130	16.904514
91........	12.62774	33.737352	3.883973	11.486384
92........	8.316769	21.109612	2.732890	7.6024107
93........	5.302622	12.792843	1.851805	4.8695207
94........	3.270208	7.4902207	1.218477	3.0177157
95........	1.941947	4.2200127	.7725837	1.7992387
96........	1.103691	2.2780657	.4620928	1.0266550
97........	.6042752	1.1743747	.2747488	.5645622
98........	.3090924	.5700995	.1327288	.2898134
99........	.1659110	.2610071	.0961803	.1570846
100........	.0641202	.0950961	.0309759	.0609043
101........	.0309759	.0309759	.0299284	.0299284

SELECT NET ANNUAL PREMIUMS PER $1000 INSURANCE

($q'_x = q_x + .020$)

Age	W.L.	20 P.L.	20 Yr. End.
15..............	25.85	35.67	48.51
20..............	26.96	36.60	48.71
25..............	28.35	37.72	48.89
30..............	30.24	39.20	49.22
35..............	32.88	41.31	49.98
40..............	36.52	44.25	51.40
45..............	41.44	48.25	53.81
50..............	48.03	53.69	57.67
55..............	56.78	61.07	63.63
60..............	68.35	71.19	72.60
65..............	83.61	85.15	85.77

Age x	q'_x	$q'_{(x)+1}$	$q'_{(x)+2}$	$q'_{(x)+3}$	$q'_{(x)+4}$	$q'_{(x)+5}$	Age Attained $(x+5)$
15	.02247	.02324	.02341	.02355	.02372	.02392	20
16						.02402	21
17						.02412	22
18						.02418	23
19						.02425	24
20	.02273	.02359	.02380	.02396	.02413	.02431	25
21						.02435	26
22						.02439	27
23						.02441	28
24						.02443	29
25	.02293	.02384	.02402	.02412	.02427	.02446	30
26						.02448	31
27						.02451	32
28						.02459	33
29						.02468	34
30	.02301	.02393	.02411	.02422	.02445	.02478	35
31						.02494	36
32						.02512	37
33						.02532	38
34						.02556	39
35	.02316	.02429	.02457	.02480	.02523	.02584	40
36						.02616	41
37						.02654	42
38						.02694	43
39						.02742	44
40	.02371	.02519	.02570	.02617	.02690	.02794	45
41						.02852	46
42						.02918	47
43						.02989	48
44						.03070	49
45	.02482	.02690	.02782	.02866	.02992	.03158	50
46						.03254	51
47						.03362	52
48						.03478	53
49						.03608	54
50	.02678	.02979	.03141	.03285	.03489	.03747	55
51						.03902	56
52						.04069	57
53						.04251	58
54						.04449	59
55	.02994	.03447	.03712	.03951	.04271	.04668	60
56						.04903	61
57						.05158	62
58						.05437	63
59						.05738	64
60	.03492	.04170	.04595	.04974	.05468	.06066	65
61						.06418	66
62						.06803	67
63						.07216	68
64						.07664	69
65	.04252	.05267	.05931	.06517	.07263	.08147	70

Age	l_x	d_x	q'_x
71	13744	1192	.08670
72	12552	1159	.09233
73	11393	1121	.09839
74	10272	1078	.10492
75	9194	1029	.11194
76	8165	976	.11951
77	7189	918	.12765
78	6271	855	.13631
79	5416	789	.14569
80	4627	721	.15574
81	3906	650	.16642
82	3256	579	.17787
83	2677	509	.19005
84	2168	440	.20315
85	1728	375	.21707
86	1353	314	.23180
87	1039	257	.24729
88	782	207	.26408
89	575	162	.28170
90	413	124	.30035
91	289	92	.31946
92	197	67	.34108
93	130	47	.36188
94	83	32	.38364
95	51	21	.40776
96	30	13	.43111
97	17	8	.46340
98	9	4	.47763
99	5	3	.52000
100	2	1	.58250
101	1	1	.59143
102	0	0	.68667
103	0	0	1.00000

Age (x)	l_x	$l_{(x)+1}$	$l_{(x)+2}$	$l_{(x)+3}$	$l_{(x)+4}$	$l_{(x)+5}$	Age Attained ($x+5$)
15	99822	97579	95311	93080	90888	88732	20
16						86610	21
17						84530	22
18						82491	23
19						80496	24
20	88525	86513	84472	82462	80486	78544	25
21						76635	26
22						74769	27
23						72945	28
24						71164	29
25	78325	76529	74705	72911	71152	69425	30
26						67727	31
27						66069	32
28						64450	33
29						62865	34
30	69212	67619	66001	64410	62850	61313	35
31						59794	36
32						58303	37
33						56838	38
34						55399	39
35	61082	59667	58218	56788	55380	53983	40
36						52588	41
37						51212	42
38						49853	43
39						48510	44
40	53693	52420	51100	49787	48484	47180	45
41						45862	46
42						44554	47
43						43254	48
44						41961	49
45	46787	45626	44399	43164	41927	40673	50
46						39389	51
47						38107	52
48						36826	53
49						35545	54
50	40137	39062	37898	36708	35502	34263	55
51						32979	56
52						31692	57
53						30402	58
54						29110	59
55	33543	32539	31417	30251	29056	27815	60
56						26517	61
57						25217	62
58						23916	63
59						22616	64
60	26895	25956	24874	23731	22551	21318	65
61						20025	66
62						18740	67
63						17465	68
64						16205	69
65	20228	19368	18348	17260	16135	14963	70

Age (x)	d_x	$d_{(x)+1}$	$d_{(x)+2}$	$d_{(x)+3}$	$d_{(x)+4}$	$d_{(x)+5}$	Age Attained ($x+5$)
15	2243	2268	2231	2192	2156	2122	20
16						2080	21
17						2039	22
18						1995	23
19						1952	24
20	2012	2041	2010	1976	1942	1909	25
21						1866	26
22						1824	27
23						1781	28
24						1739	29
25	1796	1824	1794	1759	1727	1698	30
26						1658	31
27						1619	32
28						1585	33
29						1552	34
30	1593	1618	1591	1560	1537	1519	35
31						1491	36
32						1465	37
33						1439	38
34						1416	39
35	1415	1449	1430	1408	1397	1395	40
36						1376	41
37						1359	42
38						1343	43
39						1330	44
40	1273	1320	1313	1303	1304	1318	45
41						1308	46
42						1300	47
43						1293	48
44						1288	49
45	1161	1227	1235	1237	1254	1284	50
46						1282	51
47						1281	52
48						1281	53
49						1282	54
50	1075	1164	1190	1206	1239	1284	55
51						1287	56
52						1290	57
53						1292	58
54						1295	59
55	1004	1122	1166	1195	1241	1298	60
56						1300	61
57						1301	62
58						1300	63
59						1298	64
60	939	1082	1143	1180	1233	1293	65
61						1285	66
62						1275	67
63						1260	68
64						1242	69
65	860	1020	1088	1125	1172	1219	70

BOOK REVIEWS

Mathematics of Finance. By H. L. RIETZ, A. R. CRATHORNE, and J. CHARLES RIETZ. New York: Henry Holt & Co., 1921. Pp. xiii+280.

The appearance of this book will give genuine satisfaction to a large class of people who believe that a good elementary course in the application of mathematics to everyday financial problems should be offered students in schools and colleges. The chief obstacle heretofore met in arranging such a course has been the absence of a suitable textbook, and this new publication will be welcomed, since it furnishes a satisfactory solution of this difficulty.

The book has been carefully written and the well-chosen material has been presented in a thoroughly teachable form. It is evident that it has been edited with painstaking care.

The authors are to be especially commended on the unique arrangement of the book, whereby parts treating with special problems may be omitted without destroying continuity when a brief course only is offered. This feature of the book also adds to its value as a reference book for persons interested in financial problems connected with banking, building and loan associations, investments and securities, or life insurance. It is apparent that the authors also had in mind those who are working in financial institutions and studying privately. To such this treatise will be very welcome, for the subjects dealt with are presented in an unusually clear manner, including whatever of pure mathematics is needed for a complete understanding of the work, so that a student with no more than a high-school education can study this book to advantage without supervision. The problems interspersed throughout are very practical, and the inclusion of logarithms, interest, and mortality tables render their solution possible without outside reference, making this a very complete and handy volume.

It seems that the value of the book might have been somewhat enhanced for many students who might wish to pursue any particular subject further if the authors had given more complete references to other treatises. This is but a slight criticism, however, of a book which is timely and which is a real contribution to the subject of applying exact science to business problems.

CHARLES H. BECKETT

United States Life Tables, 1890, 1901, 1910 and 1901–10. Explanatory, Text, Mathematical Theory, Computations, Graphs, and Original Statistics. Also Tables of Life Annuities, Life Tables of Foreign Countries, and Mortality Tables of Life Insurance Companies. By JAMES W. GLOVER. Washington: Government Printing Office. Pp. 496.

The preparation of this volume marks an important advance in the study of vital statistics in the United States. The letter of transmittal states that the "volume is intended to be of service primarily as a source of information to the public. It should be particularly useful to public-health officials, students of vital statistics, physicians, sociologists, actuaries, statisticians, and others interested in the improvement of public health." It will serve this purpose, but it is also of much value to the actuary as a technical contribution.

The work is divided into eight parts. Part I gives a non-technical description and explanation of life-table functions. Part II gives seventy-four mortality tables based on different subclasses of the population of the registration states. Part III gives twelve life tables of foreign countries and ten mortality tables based on experiences of life insurance companies. Part IV presents graphs of life-table functions. Part V gives certain life annuities, life insurance premiums and commutation columns. Part VI gives the mathematical theory of the construction of life tables. Part VII gives a detailed account of the process of carrying out the calculations. Part VIII gives tables of the original statistics and an explanation of the different types of data.

The methods of life-table construction are very clearly presented. Even many details of the actual process of carrying out the work on adding machines or otherwise are shown by means of photographs of diagrams and adding-machine tapes used in numerical calculations. On account of the variety of forms in which the original data were given, various methods were needed in finding the rates of mortality. Thus in some cases the number of births were registered, while in other cases they had to be computed. The very commendable practice was followed of explaining the method in such a way that another actuary could reproduce the rates found.

The many tables presented in this volume are simply a mine of information for comparative purposes. Part VI on the mathematical theory of the construction of life tables is the part of the work which should prove of much interest to the actuaries interested in the fundamental theory of life-table construction. The reviewer believes it correct to say that pages 329–44 give the first clear and detailed statement in the English language of the theory of the continuous flow of population, with applications to the concrete problems of life-table construction. The development of these methods centers around the names of Knapp, Zeuner, and Lexis. The author has done an important service in bringing a clear presentation of these methods before American actuaries. In this theory the chief aggregates of the living and the dead corresponding to assigned birth and age intervals are derived in terms of definite integrals, and the rates of mortality are obtained as the solution of a linear differential equation. The results are not left in theoretical form, but concrete cases are carried out to show how the theory was applied to census data.

H. L. Rietz

Income in the United States, Its Amount and Distribution, 1909–1919 (Vol. I). By the Staff of the National Bureau of Economic Research. New York: Harcourt, Brace & Co., 1921.

This is the first volume of a series of investigations in statistical economics planned by the National Bureau. It is an effort to determine as accurately as possible the national income in commodities and paid-for services, its fluctuations, distribution, and weighted value. The Bureau has made two independent estimates based respectively on data of production and of incomes. The agreement between the two estimates is surprising. For 1918 the estimate by production was $60,400,000,000 and by incomes $61,700,000.000. For the year of widest variation (1913) the difference was only 6.9 per cent. The authors believe their results to be accurate within 5 per cent.

The final estimate shows an increase in the national money income from $34,400,000,000 in 1913 to $61,000,000,000 in 1918, but in terms of purchasing power based on the price level of 1913 the increase is from 34.4 billions to only 38.8 in 1918. In the estimate by sources of production it appears that in 1913 agriculture contributed 16.54 per cent and in 1918, 21.01 per cent to the total. In 1918 personal incomes over $2,000 contributed $23,200,000,000 to the author's total of $61,700,000,000, while the aggregate reported by the Internal Revenue Bureau was only $13,700,000,000. The difference includes income not subject to tax as well as income that has evaded the tax.

The National Bureau of Economic Research was incorporated on January 29, 1920. Its method is quantitative research to reduce economic and industrial problems to definite facts by the best available methods. Volume II of its first pulication contains the working details of which Volume I is the summary. The Bureau has selected business cycles for its next investigation, which will include a study of the amounts and fluctuations of the national savings (i.e., additions to stocks and tools of production), a subject of the greatest importance at this time, and as to which there exists little information and much confusion of thought. As the Bureau says, "Most delusions about public policy arise from ignorance of fundamental facts far more than they arise from bad reasoning or bad feeling."

Percy H. Evans

A Treatise on Probability. By John Maynard Keynes, London: Macmillan Co., 1921. Pp. xi+466.

This book by a well-known writer on economic subjects very naturally attracts the immediate attention of anyone specially interested in the subject of probability. The book may be characterized in the main as a sort of critique on the logic of probability theory.

The book is divided into five parts: Part I deals with fundamental ideas such as the meaning of probability, its measurement, and relation to the theory of knowledge. While the book aims at the exposition of a logical theory, it is explicitly stated that it does not employ a perfectly exact terminology, nor the minute refinements of language necessary to avoid error in fundamental logical inquiries. Part II deals with fundamental theorems of necessary inference, of probable inference, and with problems of inverse probability including averages.

Part III deals with the nature of argument by analogy and by induction and examines the ground on which we justify such methods. Part IV deals with philosophical applications of probability, including the application to conduct. Part V gives an exposition of the foundations of statistical inference. In this connection a very high place is given to the theorems of Bernoulli, Poisson, and Tchebycheff, and to the methods of Lexis. This part presents the outline of a constructive theory. But the actuary or statistician who expects to find in this book such a constructive theory as will help him in a very direct way in the analysis of statistical data will probably be disappointed. On the other hand, those who are interested in the logical basis of statistical inference will find the book interesting and suggestive, although it is not, nor does it aim to be, the last word as to logical rigor.

H. L. Rietz

EXAMINATION FOR ADMISSION TO THE CLASS OF ASSOCIATE, HELD APRIL, 1922

SECTION A. FIRST PAPER

1. *a*) State and define the four laws for multiplication.

b) Define and prove the factor theorem.

2. Prove that the product of two numbers equals the product of their highest common factor and least common multiple.

3. Factor:

a) $(a+b+c)^3+2(a^3+b^3+c^3)-6abc$

b) $x^3+4x^2-17x-60$

c) $a^3(b-c)+b^3(c-a)+c^3(a-b)$

4. Simplify:

a) $$\frac{x^4+3x^3-8x^2-3x+7}{x^4-3x^3-20x^2+57x-35}$$

b) $$\left\{a+b+\frac{(a-b)^2}{4(a+b)}-a\right\}-\left\{\frac{a+b}{4}+\frac{ab}{a+b}-b\right\}$$

5. Solve:

a) $$\begin{aligned} x^2+xy+2y^2&=74 \\ 2x^2+2xy+y^2&=73 \end{aligned}$$

b) $$\begin{aligned} x^4+x^2y^2+y^4&=2613 \\ x^2+xy+y^2&=67 \end{aligned}$$

6. *a*) Find three numbers whose sum is 21, and of which the greatest exceeds the least by 4, and the middle one is half the sum of the other two.

b) The sum of a number of two digits and of the number formed by reversing the digits is 110, and the difference of the digits is 6. Find the numbers.

7. An arithmetical progression consists of 21 terms; the sum of the three terms in the middle is 129, and the sum of the last three terms is 237. Find the first and last terms of the series and its sum.

8. Prove that, if the opposite sides of a quadrilateral are equal, the quadrilateral must be a parallelogram.

9. Prove that, if a line is perpendicular to a radius at its outer extremity, it is tangent to the circle at that point.

10. Prove that, in an obtuse-angled triangle, the square of the side opposite the obtuse angle is equal to the sum of the squares of the other two sides, increased by twice the product of one of the sides and the projection of the other side upon it.

SECTION A. SECOND PAPER

1. *a*) Develop formula for finding the logarithm of any number to base c from the logarithm of that number to base d.

b) Find the seventh root of .00324, having given that log 44092388 = 7.6443636.

2. *a*) Prove that $(ab+xy)(ax+by)>4abxy$.

b) Show that $(x+y+z)^3>27(y+z-x)(z+x-y)(x+y-z)$.

3. Is the following series convergent or divergent?

$$\frac{1^2}{2^2}+\frac{1^2\cdot 3^2}{2^2\cdot 4^2}x+\frac{1^2\cdot 3^2\cdot 5^2}{2^2\cdot 4^2\cdot 6^2}x^2+\ \ldots\ .$$

4. Sum the following to n terms and to infinity:

$$\frac{1}{1\cdot 2\cdot 3}+\frac{3}{2\cdot 3\cdot 4}+\frac{5}{3\cdot 4\cdot 5}+\frac{7}{4\cdot 5\cdot 6}+\ \ldots\ .$$

5. A and B are two inaccurate arithmeticians whose chances of solving a given problem correctly are 1/8 and 1/12 respectively; if they obtain the same result, and if it is 1,000 to 1 against their making the same mistake, find the chance that the result is correct.

6. Solve:

$$x+y+z=a$$
$$x^2+y^2+z^2=3a^2$$
$$xy+a^2=0$$

7. Eliminate x, y, z from the equations

$$a_1x+b_1y+c_1z=0$$
$$a_2x+b_2y+c_2z=0$$
$$a_3x+b_3y+c_3z=0$$

8. In how many ways can a stenographer place n letters in n different envelopes so as to have no letter in its correct envelope?

9. Three dice are to be cast at once. If A is to pay B $1.00 for every three-spot which comes up, and if B is to pay A $1.00 if no three-spots come up, what is the percentage in favor of B or A?

10. Write down and simplify the tenth term of

$$(1+3a^2)^{\frac{16}{3}}$$

expanded.

SECTION A. THIRD PAPER

1. A pole subtends an angle of 60° at a point A due south of it; at a point B, due west of A, it subtends an angle of 45°. If the distance from A to B is 50 feet, find the height of the pole.

2. Prove geometrically, where x and y are acute and positive, that

$$\sin (x-y)=\sin x \cos y-\cos x \sin y.$$

3. Find $\sin 3x$ in terms of $\sin x$.

4. Derive the formula for the area of a triangle having given the three sides.

5. If A, B, and C are the angles of a triangle, prove that

$$\sin 2A+\sin 2B+\sin 2C=4 \sin A \sin B \sin C.$$

6. Find the equation of the circle which has the center (2, 3) and passes through (3, 2).

7. Find the equation of the line passing through the intersection of $x+y-2=0$ and $x-y+6=0$ and through the intersection of $2x-y+3=0$ and $x-3y+2=0$.

8. Find the area of the triangle whose sides are the loci of the following equations:

$$\begin{gathered} 3x+y+4=0 \\ 3x-5y+34=0 \\ 3x-2y+1=0 \end{gathered}$$

9. Find the condition that the line $y=mx+c$ may be tangent to the parabola $y^2=4ax$.

10. Find the parametric equations of the locus of a point P on a circle which rolls along the axis of x.

SECTION A. FOURTH PAPER

1. Sum to infinity the series

$$\frac{1}{m(m+r)}+\frac{1}{(m+r)(m+2r)}+\frac{1}{(m+2r)(m+3r)}+\ \ldots\,.$$

and show that

$$\frac{1}{6\times 11}+\frac{1}{11\times 16}+\frac{1}{16\times 21}+\ \ldots \text{ to infinity}\equiv\tfrac{1}{30}$$

2. Prove that

$$u_{-x}=\frac{x(n+x)}{2n^2}\,u_{-n}+\frac{n^2-x^2}{n^2}\,u_0-\frac{x(n-x)}{2n^2}\,u_n$$

and indicate a use for this formula.

3. If $u_2=-20$, $u_5=-50$, $u_7=0$, and $u_9=163$ find the general expression for u_x, third differences being known to be constant.

4. Find by the method of factorials the form of u_x having given that $u_1=2$, $u_2=8$, $u_3=16$, $u_4=26$, and $u_5=38$.

5. Prove, by induction or otherwise, that

$$u_x=u_0+\frac{x}{n}\Delta u_{-n}+\frac{x(x+n)}{n^2\underline{|2}}\Delta^2 u_{-2n}+\frac{x(x+n)(x+2n)}{n^3\underline{|3}}\Delta^3 u_{-3n}+\ \ldots\,.$$

6. Given u_a, u_b, u_c, u_d, and u_e different values of u, not necessarily equidistant, write down the expression for u_x by the method of "divided" (or "adjusted") differences.

If $u_0=u_3=0$, $u_4=112$, $u_{10}=9100$ and $u_{20}=156{,}400$, deduce the general expression for u_x in powers of x.

7. Determine a series of such a nature that the terms after the first shall be respectively double the first terms of the successive orders of differences: that is, $u_2=2\Delta^1 u_1$, $u_3=2\Delta^2 u_1$, and so on.

8. If u_0, u_1, u_2, ... u_{n-1} be n terms of a series of equidistant values of any rational integral algebraic function of x, and S_n denote their sum, show symbolically that

$$S_n=nu_0+\frac{n(n-1)}{\underline{|2}}\Delta u_0+\frac{n(n-1)(n-2)}{\underline{|3}}\Delta^2 u_0+\ .\ .\ .\ .$$

9. Show that the finite integral of

$$a^x \text{ is } \frac{a^x}{a-1}+c,$$

where c is a quantity independent of x.

SECTION B. FIRST PAPER

1. *a*) Define interest.
   b) What is the distinction between simple and compound interest? Which is greater?
   c) What is meant by nominal and effective rates of interest?
   d) Define annuity; amoritization; sinking fund.

2. Express i, j, and δ each in terms of the others, expanding each expression.

3. Develop an expression for the value of an annuity of one per annum, payable at the end of each five-year period for 20 years, at the rate i.

4. Find the value of a 20-year decreasing annuity, of which the payments are successively 20, 19, 18, etc., at 4 per cent, having given $a_{\overline{20}|}=13.59$.

5. Prove $\frac{1}{a_{\overline{u}|}^{(p)}} - \frac{1}{s_{\overline{n}|}^{(p)}} = j_{(p)}$.

6. Find to seven places of decimals the force of interest corresponding to an effective rate of 1 per cent.

7. Find the numerical value of an annuity payable at the end of each year for 19 years, given

$$a_{\overline{5}|} = 4.33 \qquad v^5 = .784$$
$$a_{\overline{7}|} = 5.79 \qquad v^7 = .711$$

8. In the case of a debt of $a_{\overline{n}|}^{(p)}$ repayable with interest at the effective rate i by an annuity payable p times a year, state:

a) The principal contained in the *m*th payment.

b) The interest contained in the *m*th payment.

c) The outstanding principal just after the *m*th payment.

9. What is an account? Distinguish between real, nominal, expense, income, personal, and impersonal accounts.

10. *a*) Formulate a rule to make clear just when an account should be debited and when credited.

b) Define and differentiate capital and revenue expenditures.

SECTION B. SECOND PAPER

1. Develop the formula:

$$a_x^{(m)} = \frac{1}{j_{(m)}} - A_x \frac{i}{j_{(m)}} \left(\frac{1}{j_{(m)}} + \frac{1}{m} \right)$$

2. Give verbal interpretation of the following:

$$P_x = \frac{1}{1 + a_x} - d$$

$$A_x = 1 - d a_x$$

$${}_{n}V_x = \frac{a_x - a_{x+n}}{1 + a_x}$$

3. Derive the formula in cummutation symbols for the annual premium on an endowment assurance of \$1,000.00 when all the premiums paid are to be returned along with the sum assured at whatever time that may be.

4. Derive the formula in cummutation symbols for the nth year reserve in problem 3.

5. Assuming Makeham's Law, demonstrate the equivalent age method of joint-life calculations.

6. Express in symbols the probability that of the two lives aged 35 and 40, exactly one will survive 10 years.

7. What is the meaning of the symbol

$$Q^{1}_{x:\overline{y(\overline{t|})}}$$

8. Define and illustrate "central death rate."

9. Calculate the formula for the net annual premiums and terminal reserves (Illinois Standard) on a 10-payment 23-year endowment.

10. Express M_x in terms of N_x.

SECTION B. THIRD PAPER

1. Obtain a finite difference expression for

$$\frac{d^2 f(x)}{dx^2}$$

2. What is the fundamental formula of relation for the treatment of joint life annuities by the "adjusted interest" method? Deduce this relation in the case of two lives.

3. Solve the equation $u_{x+1} - au_x = b$ where a and b are constant.

4. Show that the force of mortality, μ_x may be expressed in terms of the complete expectation in the form

$$\mu_x = \frac{1}{\mathring{e}_x} \left\{ 1 + \frac{d\mathring{e}_x}{d_x} \right\}$$

5. What is the process known as "mechanical quadrature"? Given the expansion $u_x = u_0 + x\Delta u_0 + \frac{x(x-1)}{\underline{2}}\Delta^2 u_0 +$, etc., deduce a general expression for

$$\int_0^n u_x d_x$$

6. If the complete expectation of life at age x is $a + bc^x$ where a, b, and c are constant, obtain an expansion for the number living at age x in terms of a, b, c, and x.

SECTION B. FOURTH PAPER

1. Deduce Fackler's accumulation formula.

2. How would you determine the mean reserve for the nth year on a life annuity payable in quarterly payments?

3. What reserve should be held at the end of the premium-paying period under a limited-payment life policy, to allow for expenses of k per annum, and for immediate payment of the sum insured at death?

4. Express ${}_nV_x$ in terms of single premiums; annuities; annual premiums and interest rate.

5. Two mortality tables are constructed by modifications of a standard table. The first table is based on the assumption that $q'_x = (1+k)q_x$, and the second upon the assumption that $q'_x = q_x + c$. How would reserves for whole life policies based on the modified tables compare with corresponding values by the standard table?

6. What is the effect of an increase in the interest rate upon policy values? Prove your answer.

7. How would you value an annual premium whole life continuous monthly-instalment policy?

8. Under what conditions would a net premium valuation be inadequate as a measure of solvency?

9. Discuss the modified preliminary-term method of valuation from the standpoint of adequacy and adaptability to present-day conditions.

10. Prove algebraically and by general reasoning that

$${}_nV_x = \frac{P_x - P^{1}_{x\overline{n|}}}{P^{1}_{x\overline{n|}}}$$

EXAMINATION FOR ADMISSION TO THE CLASS OF FELLOWSHIP, HELD APRIL, 1922

SECTION A. FIRST PAPER

1. Name and describe the methods used in three mortality investigations made during the last one hundred years.

2. Is there any danger of too much refinement in graduating a mortality table? Explain fully.

3. Describe (*a*) Lubbuck's Formula, (*b*) Makeham's Formula, (*c*) Spencer's Formula.

4. In the preparation of a mortality table from a company's own experience what rules would you follow with respect to (*a*) terminations, (*b*) reinstatements, (*c*) new issues. (*d*) What particular dangers are to be avoided?

5. Point out the merits and demerits in the various methods of handling sub-standard lives, in current use.

6. Give a brief history of the disability benefit as issued in connection with life insurance policies.

7. Derive the formula for the premium required for waiver of premium and $10.00 per month (per $1,000 of life insurance) on a 10-payment life policy; disability coverage to end at age 60.

8. Derive the formula for computing the mean reserve required under conditions described in question 7.

SECTION A. SECOND PAPER

1. Describe the one-factor, two-factor, and three-factor methods of distributing surplus. Which of the three methods gives in your opinion the best results, stating your reasons therefor?

2. Assuming that your company distributes its surplus according to a three-factor method, how would you obtain the "loading" factor and the "mortality" factor?

3. You are asked to prepare a set of non-participating rates for a company operating in the Middle West states. Upon what basis of mortality, interest, and expense would you compute such rates? Show the formula for a 20-payment life policy.

4. Upon what basis would you calculate:

a) The gross premiums for a non-participating deferred annuity beginning at age 65?

b) A participating child's endowment policy providing for return of premiums with 4 per cent compound interest in the event of the death of the child within the endowment period, the premiums ceasing in event of the death of the parent within the endowment period?

c) A non-participating term policy which provides for conversion at the end of the term period to a life or endowment policy without medical examination?

5. You are called upon to appear before a legislative committee to argue for the adoption of the bill favoring the modified preliminary-term method of valuation in Massachusetts. Present your argument.

6. Define gross premium valuation and net premium valuation. Under what circumstances would you recommend a gross premium valuation instead of a net valuation? How much truth is there in the statement that a preliminary-term valuation is a gross premium valuation?

7. An ordinary life policy for $10,000 issued at age 35 has been in force five years. The insured desires to change it to an ordinary life continuous monthly income policy, 20 years certain, age of the beneficiary being now 35. What proposals would you make to the insured, stating the requirements and the method of obtaining the cost of change?

8. What general principles underlie changes:

a) From higher to lower-priced policies?

b) From lower to higher-priced policies?

SECTION B. FIRST PAPER

1. *a*) Discuss the statement that has recently been made by a committee of actuaries that it is unalterably opposed to "forcing the balance" in the Gain and Loss Exhibit.

b) What is your opinion of the comparative merits of the two methods of obtaining the expected mortality, where under one method the mean reserves are deducted from the actual death losses, and under the other the terminal reserves are deducted?

2. A company doing a non-participating as well as a participating business has not kept a separate financial account of its participating policies. It is now required to do so. Draft a report to the executive committee of the company showing how this may be done so that the surplus derived from non-participating policies may be separated from the surplus derived from its participating policies.

3. *a*) What are the fundamental causes underlying the recent improvement in the market price of bonds?

b) Suppose your company has been investing 90 per cent of its funds in farm mortgages and is now deliberating whether it will continue to do so or invest its funds equally between farm mortgages and municipal, state, and government bonds. What would you recommend your company to do, stating your reasons therefor?

4. Give four illustrations of tax-free securities. Are such securities more desirable investments for life insurance companies than securities not exempt from taxation?

5. *a*) Explain how the rate of exchange is established between the United States of America and Great Britain in normal times.

b) What is the reason for the present state of depreciated exchange?

6. *a*) Give a short history of the use of irredeemable paper money in the United States.

b) State your opinion of the great expansion of paper money in Germany and its present and ultimate effect on the economic condition of that country.

7. Explain the principal features of the Revenue Act of 1921 as it affects life insurance companies.

8. *a*) Discuss the recent change in the incontestable clause in the insurance laws of Illinois and the reason therefor.

b) Is it advisable in your opinion to incorporate the aforesaid change in policies issued in other states wherever the laws of these states permit?

SECTION B. SECOND PAPER

1. Give in outline form the provisions of a 20-payment life policy for $1,000 with disability benefit consisting of waiver of premium and payment of $10.00 per month for life without reducing the amount of insurance; the disability coverage to cease at age 60.

2. What important events in the history of life insurance are suggested by the following dates?

364 A.D.
1671
1691
1771
1785
1815
1843
1858
1861
1906

3. Give a brief outline of the work performed by the following men, giving dates:

a) John DeWitt
b) Dr. Richard Price
c) John N. Tetens
d) Lorenzo Tonti
e) Edmund Halley
f) Thomas Simpson
g) Abram DeMoivre
h) Joshua Milne
i) Wm. DeMorgan
j) Wm. Sutton
k) Elizur Wright
l) Sheppard Homans

4. Write a critique on some public pension fund with which you are familiar and compare same with some private pension fund or funds established by some private corporation.

5. Give a brief description of (*a*) the Dean Schedule for fire insurance rating; (*b*) the Universal Mercantile Schedule.

6. Define and describe (*a*) "general average"; (*b*) "particular average" as applied to marine insurance.

7. Give a brief description of the application of actuarial science to workmen's compensation problems.

REPORT OF THE TREASURER OF THE AMERICAN INSTITUTE OF ACTUARIES FOR THE YEAR ENDING MAY 31, 1922

RECEIPTS

Cash on hand May 1, 1921		$ 874.20
Dues	$4,510.00	
Records	503.12	
Examinations	390.00	
Interest from bank	25.60	5,428.72
		$6,302.92

DISBURSEMENTS

Postage	$ 212.21	
Printing	2,350.69	
Library	164.92	
Exchange	16.18	
Stenographer	339.67	
Supervising examinations	28.95	
Flowers	10.00	
Traveling expenses of board members	59.84	
Express	7.86	
Entertainment	85.51	
Refund on examinations and records	20.00	
Miscellaneous	59.50	
Total disbursements		$3,355.33

Surplus

U.S. government $4\frac{3}{4}$ per cent notes, 1926	2,039.34
Cash on hand, May 31, 1922	908.25
	$6,302.92

MINUTES OF THE MEETING OF THE AMERICAN INSTITUTE OF ACTUARIES HELD AT THE HOTEL LA SALLE, CHICAGO, ILLINOIS, JUNE 1 AND 2, 1922

The Institute was called to order by President Graham at 10:30 A.M., Thursday, June 1, 1922, and the following Fellows and Associates were present:

FELLOWS

S. E. Allison
E. C. Ames
L. A. Anderson
T. W. Appleby
O. J. Arnold
W. N. Bagley
C. H. Beckett
J. P. Bowerman
H. W. Buttolph
D. F. Campbell
E. R. Carter
L. M. Cathles
A. Coburn
H. R. Corbett
H. W. Curjel
F. A. Draper
P. H. Evans
James Fairlie
J. E. Flanigan
J. B. Gibb
J. W. Glover
George Graham
Marcus Gunn
F. J. Haight
J. C. Harvey
J. E. Higdon
J. M. Laird
E. L. Marshall
F. B. Mead
Henry Moir
P. V. Montgomery
W. O. Morris
J. H. Nitchie
J. G. Parker
G. B. Pattison
S. L. Phelps
T. A. Phillips
H. L. Rietz
J. C. Rietz
G. W. Sanders
J. C. Seitz
C. F. Stein
B. J. Stookey
W. M. Strong
R. M. Webb
F. S. Withington

ASSOCIATES

Albert Babbitt
B. S. Beecher
G. W. Bishop
C. E. Brooks
E. G. Brown
Helen Clark
W. P. Coler
J. A. Copeland
E. G. Fassel
I. L. Grimes
J. V. Hanna
W. J. Hiller
W. M. Johnson
F. R. Jordan
A. W. Larsen
H. C. Marvin
R. C. McCankie
E. A. Porter
M. R. Scott
H. G. Sellman
C. O. Shepherd
R. B. Sturtevant
F. D. Strudell
H. J. Williams

The following contributing companies were also represented by other than Fellows or Associates:

CONTRIBUTING MEMBERS

Aetna Life Ins.	E. E. Cammack
American Central	H. R. Wilson
Atlantic Life	J. W. Sinton, Jr.
Bankers Life Co., Des Moines	Geo. W. Fowler
Bankers Reserve Life, Omaha	G. D. Babbitt
Cedar Rapids Life	C. B. Svoboda
Central States Life, St. Louis	Miss Eloise Koch
Columbus Mutual Life	Carl Mitcheltree
Continental Life, Wilmington, Del.	Adolph A. Rydgren
Equitable Life of the District of Columbia	G. A. Clark
Federal Life	L. D. Cavanaugh A. R. Thompson
Franklin Life	J. A. Budinger
Great Northern Life	J. A. Sullivan J. P. P. Oliver
Great-West Life	F. D. MacCharles
Illinois Life	Harry G. Pinger
Jefferson Standard Life	J. B. Smith
Lincoln National Life	A. J. McAndless E. L. Carvin W. McLachlan C. F. Cross
Merchants Life	Frank H. Davis
Metropolitan Life	M. W. Torrey Sam'l Milligan
National Life and Accident Co.	W. H. McBride
Peoria Life	P. F. Bourscheidt
Public Savings Life	Carl G. Winter Dr. Emil G. Winter
Reliance Life	J. N. Jamison
Scranton Life	R. Merriman
Security Life of America	H. E. Johnson
Southern States Life	W. R. Halliday
State Life	Gertrude Pardieck

The presidential address was delivered by the President, Mr. Graham.

The minutes of the meeting held November 17 and 18, 1921, as printed in No. 22 of the *Record* were approved.

The Secretary presented a summary of the actions of the Board since the last annual meeting of the Institute and such actions were approved and confirmed.

The report of the Treasurer was presented and referred to the Auditing Committee.

The report of the committee on the Revision of the Gain and Loss Exhibit was presented and accepted.

The Institute then proceeded to the consideration of formal papers. The morning session was adjourned at 12:45 P.M.

During the afternoon session the consideration of formal papers was continued and the afternoon session was adjourned at 5:00 P.M.

The Institute reconvened at 9:30 A.M. on Friday, June 2, and a discussion of formal papers was continued. The morning session was adjourned at 12:30 P.M.

During the afternoon session the discussion of formal papers was concluded.

The proposed amendment to Article IV of the By-Laws by adding the following was then presented: "And also except that any person who shall have attained the age of seventy years while a Fellow of the Institute, having been a Fellow on the date of the first annual meeting, or otherwise for a period of at least twenty years, shall enjoy all the privileges of membership without further payment of dues."

Upon motion duly seconded the amendment was unanimously adopted.

The proposed amendment of Article X of the constitution to read as follows was then presented:

> Any Associate whose application shall be approved by the Board of Governors may become a Fellow if at least twenty-five years of age under the following conditions: Every member of the Board of Governors shall have confidential notice of the application at least twenty days prior to the meeting at which it shall be acted upon, and the applicant shall pay such fee and pass such final examination as shall be prescribed by the Board of Governors. Otherwise no one shall be admitted as a Fellow unless recommended by a duly called meeting of the Board of Governors followed by a ballot of the Institute either in person or by mail.
>
> Confidential notice of such recommendation shall be mailed by the Secretary to every Fellow, and after twenty days, if not more than seven negative votes and affirmative votes of not less than half the total number of Fellows have been cast, the applicant shall become a Fellow.

Upon motion duly seconded the amendment was unanimously adopted.

The proposed amendment to Article II of the By-Laws by adding the following was then presented:

> During any interim between meetings of the Board of Governors the President may, and upon written request by three members of the Board, the President or Secretary shall, submit to the Board by personal communication in writing, mailed or delivered to each member of the Board, any matter of business requiring consideration or action by the Board. The votes of the Board, communicated in like form and manner to the President or Secretary, shall have the same effect as though voted at a regular or called meeting, provided no member of the Board votes against such action or in favor of postponement to a subsequent meeting of the Board.

Upon motion duly seconded the amendment was unanimously adopted.

The proposed amendment to Article VI of the By-Laws was then presented as follows:

> Amendments: Upon the written request of five Fellows of the Institute, the Secretary shall forthwith transmit by mail to the Fellows of the Institute any proposed amendment to the By-Laws, and such amendment shall become effective provided it shall receive the favorable vote of two-thirds of the Fellows present and voting at the duly called meeting of the Institute next succeeding the mailing of such notice by the Secretary, and held not less than thirty days after the mailing of such notice.

Upon motion duly seconded the amendment was unanimously adopted.

The Institute then proceeded with the election of officers which resulted as follows:

President	L. M. Cathles
Vice-President	James Fairlie
Secretary	G. B. Pattison
Treasurer	B. J. Stookey
Governor for three years	R. G. Hunter
Governor for three years	J. G. Parker
Governor for one year	D. F. Campbell

The meeting adjourned at 4:30 p.m.

G. B. Pattison, *Secretary*

CONSTITUTION

NAME

Article I. This organization shall be called "AMERICAN INSTITUTE OF ACTUARIES."

OBJECT

Art. II. The object of the American Institute of Actuaries is to advance the Science of Insurance Mathematics and the knowledge of the theory and practice of Life Insurance and related interests by associating together persons of like interests.

MEMBERSHIP

Art. III. The membership of the Institute shall be composed of three classes, Fellows, Associates, and Contributing Members.

OFFICERS

Art. IV. The Officers shall consist of a President, a Vice-President, a Secretary, a Treasurer, a Librarian, and an Editor of *The Record.*

GOVERNORS

Art. V. The Board of Governors shall consist of the Officers, the ex-Presidents, if Fellows, and six other Fellows.

DUTIES OF OFFICERS AND GOVERNORS

Art. VI. The duties of the officers shall be such as usually appertain to their respective offices or as may be prescribed from time to time by the Board of Governors. The duties of the Board of Governors shall be in general to manage the affairs of the Institute. It shall have the power, if the Institute be not then in session in annual meeting, to fill all vacancies occasioned by death or resignation of Officers or Governors, such appointees to serve until the next annual meeting of the Institute and until their successors be elected. Appropriate subcommittees may be appointed by the Board of Governors for such matters as from time to time may be found desirable.

ELECTION OF OFFICERS AND GOVERNORS

Art. VII. The President, Vice-President, Secretary, and Treasurer shall be elected at each annual meeting to serve until their successors be elected. The President and Vice-President shall not be eligible for election to the same office at three successive annual meetings. The Librarian and the Editor of *The Record* shall be elected by the Board of Governors, subject to confirmation by the Institute at each annual meeting, and shall serve until their successors be elected. At each annual meeting two Governors shall be elected to serve until the third succeeding annual meeting and until their successors be elected. They shall not be eligible for election to succeed themselves at the same meeting at which their terms expire. Any vacancies existing on the Board shall be filled by election at each annual meeting, the Fellow so elected to serve during the unexpired term of his predecessor. All elections shall be by ballot.

MEETINGS

Art. VIII. The annual meeting of the Institute shall be held between the fifteenth day of May and the fifteenth day of June in each year on a date and at a place to be designated by the Board of Governors. Forty days' notice of the time and place of meeting shall be given the membership by the Secretary. Other meetings may be called by the Board of Governors or shall be called by the President upon the request in writing of not less than ten Fellows and not less than twenty days' notice shall be given of such meetings.

ASSOCIATES

Art. IX. Anyone at least twenty-one years of age pursuing actuarial studies and looking forward to a future Fellowship may be enrolled as an Associate under the following conditions: that he shall be nominated by at least two Fellows of the Institute; that a confidential notice of such nomination shall be given by the Secretary to each Fellow of the Institute; that this nomination shall be approved by the Board of Governors not less than twenty days after such notification of nomination has been given; that he shall pay such examination fee and pass such preliminary examination as shall be prescribed by the Board of Governors. If the Board of Governors finds that a candidate has passed an equivalent examination required by another recognized society of actuaries, or has had such practical experience as in its opinion renders him qualified for Associateship, it may waive the examination herein required. An Associate shall be entitled to all the privileges of the Institute except those of voting and holding office.

ADMISSION TO FELLOWSHIP

Art. X. Any Associate whose application shall be approved by the Board of Governors may become a Fellow if at least twenty-five years of age under the following conditions: Every member of the Board of Governors shall have confidential notice of the application at least twenty days prior to the meeting at which it shall be acted upon, and the applicant shall pay such fee and pass such final examination as shall be prescribed by the Board of Governors. Otherwise no one shall be admitted as a Fellow unless recommended by a duly called meeting of the Board of Governors followed by a ballot of the Institute either in person or by mail. Confidential notice of such recommendation shall be mailed by the Secretary to every Fellow, and after twenty days, if not more than seven negative votes and affirmative votes of not less than half the total number of Fellows have been cast, the applicant shall become a Fellow.

CONTRIBUTING MEMBERS

Art. XI. Contributing Members shall be legal reserve Life Insurance Companies applying for such membership and elected thereto by a majority vote of the Board of Governors. Contributing Members shall have the use jointly with other Members of the Library under the rules of the Institute governing the same. Any person nominated by a Contributing Member shall have the privileges of Associates at any of the annual or special meetings of the Institute except during executive sessions.

QUORUM

Art. XII. Four members of the Board of Governors shall constitute a quorum; at any duly called meeting of the Institute fifteen Fellows shall constitute a quorum.

EXPULSION OR SUSPENSION OF MEMBERS

Art. XIII. The Board of Governors shall receive and hear all complaints preferred by any Fellow of this Institute against any other Fellow or Associate for misconduct in his relations to the Institute, or in his profession, or the practice thereof, or affecting the interests of the actuarial profession, provided such complaints shall be in writing plainly and specifically stating the matter complained of, and subscribed by the complainant.

The proceedings of the Board of Governors upon such complaint shall be deemed confidential and kept secret so far as written or printed reports of the same shall be necessarily and officially made in the Institute.

Each party may appear personally and by counsel. Witnesses shall vouch for the truth of their statements on their word of honor. The Board of Governors shall make its decision, and if it finds the complaint to be true and of sufficient importance, it will so report to the Institute with its recommendations.

The Institute will take such action on the report as it shall see fit; but no member shall be expelled or suspended unless by a vote of at least two-thirds of the members present and voting.

Art. XIV. No resolution expressive of opinion shall be entertained at any meeting.

AMENDMENTS

Art. XV. Upon the written request of five Fellows of the Institute, the Secretary shall forthwith transmit by mail to the Fellows of the Institute any proposed amendment to this Constitution, and such amendment shall become effective provided it shall receive the favorable vote of two-thirds of the Fellows present and voting at the duly called meeting of the Institute next succeeding the mailing of such notice by the Secretary, and held not less than thirty days after the mailing of such notice.

BY-LAWS

Article I. *Order of Business.*—At a meeting of the Institute the following order of business shall be observed, unless the Institute votes otherwise for the time being:

1. Calling of the roll.
2. Address or remarks by the President.
3. Minutes of the last meeting.
4. Summary of the business transacted by the Board since the last meeting of the Institute, presented for its information and approval.
5. Candidates for Fellowship considered and voted upon.
6. Reports of Committees and Officers.
7. At annual meeting, election of Officers and Governors.
8. Unfinished business; new business.
9. Reading of papers prepared for presentation to the Institute.
10. Discussions of papers presented.

The Board of Governors' meetings shall proceed in this order as far as it may apply to them.

Art. II. *Meetings of the Board of Governors* shall be called whenever the President or four members of the Board of Governors so request, but not without sending notice to each member of the Board ten or more days before the time appointed. Such notice shall state the subjects intended to be brought before the meeting; should other matters be passed upon, any member of the Board shall have the right to reopen the same at the next meeting.

During any interim between meetings of the Board of Governors the President may, and upon written request by three members of the Board, the President or Secretary shall, submit to the Board by personal communication in writing, mailed or delivered to each member of the Board, any matter of business requiring consideration or action by the Board. The votes of the Board, communicated in like form and manner to the President or Secretary, shall have the same effect as though voted at a regular or called meeting, provided no member of the Board votes against such action or in favor of postponement to a subsequent meeting of the Board.

Art. III. *Duties of Officers.*—The President, or in his absence the Vice-President, shall preside at meetings of the Institute and of the Board. At the Institute meetings the presiding Officer shall vote only in case of a tie, but at the Board meetings he may vote in all cases.

The Secretary shall keep a full and accurate record of the proceedings at the meetings of the Institute and of the Board, send out calls for the said meetings, and, with the approval of the President, carry on the correspondence of the Institute. Subject to the direction of the Board, he shall have immediate charge of the office and archives and other chattels of the Institute.

The Editor of *The Record*, under the general supervision of the Board, shall have charge of all matters connected with editing and printing the Institute publications. There shall be a publication known as "*The Record*," which shall contain only the proceedings of the meetings, original papers presented by Fellows and written by Fellows or Associates, and such discussions or other matters as may be expressly authorized by the Board of Governors.

The Treasurer shall send out calls for annual dues and acknowledge receipt of same; pay all bills approved by the President for expenditures authorized by the Board of the Institute; keep a detailed account of all receipts and expenditures, and present an abstract of same at the annual meetings after it has been audited by a Committee of the Board.

Art. IV. *Dues.*—Each Fellow shall pay fifteen dollars, each Contributing Member twenty-five dollars, each Associate five dollars upon entrance and a like amount at each annual meeting thereafter except in the case of Fellows not residing on this continent who shall pay seven dollars and fifty cents annually at the time stated.

It shall be the duty of the Treasurer to notify by mail any Fellow, Associate, or Contributing Member whose dues may be six months in arrears, and to accompany such notice by a copy of this article. If such Fellow, Associate, or Contributing Member shall fail to pay such dues within three months from the time of mailing such notice, the Treasurer shall report the delinquent to the Board, by whom the name of such member shall be stricken from the rolls, and such member shall cease to be a Fellow, Associate, or Contributing Member of the Institute. Such Member may, however, be reinstated by vote of the Board and upon payment of arrears of dues.

And also except that any person who shall have attained the age of seventy years while a Fellow of the Institute, having been a Fellow on the date of the first annual meeting or otherwise for a period of at least twenty years, shall enjoy all the privileges of membership without further payment of dues.

Art. V. *Designation by Initials.*--Fellows of the Institute are authorized to append to their names the initials F.A.I.A., and Associates are authorized to append to their names the initials A.A.I.A.

Art. VI. *Amendments.*—Upon the written request of five Fellows of the Institute, the Secretary shall forthwith transmit by mail to the Fellows of the Institute any proposed amendment to the By-Laws, and such amendment shall become effective provided it shall receive the favorable vote of two-thirds of the Fellows present and voting at the duly called meeting of the Institute next succeeding the mailing of such notice by the Secretary, and held not less than thirty days after the mailing of such notice.

VOL. XI NOVEMBER, 1922 PART II, No. 24

THE RECORD

American
Institute of Actuaries

PUBLISHED BY THE
AMERICAN INSTITUTE OF ACTUARIES

LANCASTER PRESS, INC.
LANCASTER, PA.

NOTICE

Article XIV of the Constitution of the American Institute of Actuaries reads as follows: "No resolution expressive of opinion shall be entertained at any meeting."

The publication of any article in "The Record" does not imply a "resolution expressive of opinion" by the Institute, nor does it make the Institute responsible therefor.

Communications to the American Institute of Actuaries should be sent to the Secretary.

RULES OF THE LIBRARY
AMERICAN INSTITUTE OF ACTUARIES

Books in the library may be consulted at any time by Fellows, Associates, and authorized representatives of Contributing Members.

Books may be withdrawn from the library by any member and retained for a period not exceeding two weeks. Such member assumes responsibility for the return to the library, in good condition, of any book withdrawn. If books are to be sent by mail or express, transportation charges will be paid by the Institute.

Volume XI NOVEMBER, 1922 Part II, No. 24

CONTENTS

Board of Governors, Officers and List of Members...... v
Address of the President, LAWRENCE M. CATHLES...... I
Discussion of Paper Entitled "A Review of Some of the Earlier Methods of Surplus Distribution, Some Proposed Methods and Some Methods Currently in Use by Life Companies in the United States," by J. CHAS. RIETZ.............................. 4

INFORMAL DISCUSSIONS

Conservation of Business.......................... 12
Reinstatement of Lapsed Policies.................... 29
Agency Problems........................... 39
Disability and Double Indemnity Benefits............ 58
Substandard Insurance.......................... 71
Reinsurance............................... 87

Book Review:

Calculus and Probability for Actuarial Students, by ALFRED HENRY. Reviewed by H. S. CURJEL.. 95
Minutes of the Meeting.......................... 97

AMERICAN
INSTITUTE OF ACTUARIES

THE BOARD OF GOVERNORS

Officers

President	Lawrence M. Cathles
Vice-President	James Fairlie
Secretary	George Benjamin Pattison
Treasurer	Bert Jay Stookey
Librarian	Edwin Richmond Carter
Editor of the Record	J. Chas. Rietz

Ex-Presidents

Henry Wright Buttolph
Oswald James Arnold
Joseph Howard Nitchie
Charles Harrison Beckett
George Graham

ELECTED MEMBERS

(To June, 1923)

Donald Francis Campbell
James Waterman Glover
*Julian C. Harvey

(To June, 1924)

Percy H. Evans

(To June, 1925)

Robertson G. Hunter
John G. Parker

* Appointed by the Board of Governors, upon resignation of J. Chas. Rietz, to serve until next annual meeting.

LIST OF MEMBERS

FELLOWS

Sinclair Edward Allison, A.A.S.
    Pan-American Life Ins. Co., New Orleans, La.
Henry Willard Allstrom, A.A.S.
    Minnesota Mutual Life Ins. Co., St. Paul, Minn.
Ernest Capron Ames, A.B., LL.B.
    Bankers Life Ins. Co., Lincoln, Neb.
Lewis Albert Anderson, B.L.
    Central Life Assurance Society of U. S., Des Moines, Iowa.
Charles Hart Angell, A.B.
    Mass. Mutual Life Ins. Co., Springfield, Mass.
Troy Wilson Appleby, A.M.
    Ohio National Life Ins. Co., Cincinnati, Ohio.
Oswald James Arnold, B.S.
    Illinois Life Ins. Co., Chicago, Ill.
W. Nelson Bagley, B.S., F.A.S.
    The Travelers Ins. Co., Hartford, Conn.
William Francis Barnard.
    Syracuse, N. Y.
Samuel Barnett, A.B., C.E.
    Atlanta, Ga.
Charles Harrison Beckett, A.B. (Mem. A.M.S.).
    State Life Ins. Co., Indianapolis, Ind.
Judah Philip Bowerman.
    George Washington Life Ins. Co., Charleston, W. Va.
George Burton Buck.
    Municipal Bldg., New York City.
    Consulting Office, 256 Broadway, New York City.
Russell Conklin Burton, A.B.
    New World Life Ins. Co., Spokane, Wash.
Henry Wright Buttolph, A.M., A.A.S.
    American Central Life Ins. Co., Indianapolis, Ind.
John Campbell Cameron, M.A., F.F.A., A.A.S.
    Great Southern Life Ins. Co., Houston, Tex.

Donald Francis Campbell, A.M., Ph.D. (Mem. A.M.S.).
343 So. Dearborn St., Chicago, Ill.
Francis Edgar Cann, M.A., F.A.S.
Southern Life and Trust Co., Greensboro, N. C.
Edwin Richmond Carter.
National Life Ins. Co. of U. S. A., Chicago, Ill.
Lawrence Maclagan Cathles, F.F.A., A.I.A., A.A.S.
Southland Life Ins. Co., Dallas, Tex.
Barret N. Coates.
Western States Life Ins. Co., San Francisco, Cal.
Arthur Coburn, F.A.S.
Northwestern Mutual Life Ins. Co., Milwaukee, Wis.
Ralph Bolles Coit.
Jefferson Standard Life Ins. Co., Greensboro, N. C.
Henry Richmond Corbett, B.Sc., Ph.M.
Insurance Exchange Bldg., Chicago, Ill.
James Douglas Craig, F.A.S.
Metropolitan Life Ins. Co., New York City.
Harald Worthington Curjel, M.A., F.I.A., A.A.S.
Illinois Life Ins. Co., Chicago, Ill.
Miles Meander Dawson, LL.D., F.A.S., F.I.A.
Suite 1005, 26 W. 44th St., New York City.
Frederick Adams Draper.
521 Miller Ave., Columbus, Ohio.
Earl Oglebay Dunlap.
Metropolitan Life Ins. Co., New York City.
James Strode Elston, A.B., F.A.S.
The Travelers Ins. Co., Hartford, Conn.
Saul Epsteen, Ph.D.
La Jara, Colo.
Percy H. Evans.
Northwestern Mutual Life Ins. Co., Milwaukee, Wis.
James Fairlie, M.A., A.A.S.
Mutual Life of Illinois, Springfield, Ill.
E. G. Fassel.
Cleveland Life Ins. Co., Cleveland, Ohio.
James E. Flanigan, F.A.S.
Bankers Life Co., Des Moines, Iowa.

Richard Fondiller, M.A., LL.B.
Equitable Life Assurance Society, 120 Broadway, New York City.
J. Burnett Gibb, F.F.A., A.I.A., F.A.S.
Penn Mutual Life Ins. Co., Philadelphia, Pa.
James Waterman Glover, A.M., Ph.D., F.A.A.S. (Mem. A.M.S.).
620 Oxford Road, Ann Arbor, Mich.
iam H. Gould, M.A., A.I.A., A.A.S.
Will256 Broadway, New York City.
George Graham, F.F.A., A.A.S., A.I.A.
Central States Life Ins. Co., St. Louis, Mo.
Winfield W. Greene.
35 Nassau St., New York, N. Y.
Marcus Gunn, A.B.
American Central Life Ins. Co., Indianapolis, Ind.
Frank J. Haight.
810–813 Hume-Mansur Bldg., Indianapolis, Ind.
Alfred Gilbert Hann.
Pacific Mutual Life Ins. Co., Los Angeles, Cal.
Julian Corneille Harvey, LL.B.
Third National Bank Bldg., St. Louis, Mo.
Frank C. Hemsing, A.A.S.
Northwestern Mutual Life Ins. Co., Milwaukee, Wis.
Carl E. Herfurth.
Montana Life Ins. Co., Helena, Mont.
John E. Higdon, A.B.
Gates Bldg., Kansas City, Mo.
I. Smith Homans, A.A.S.
Commonwealth Life Ins. Co., Louisville, Ky.
Francis Moffat Hope, A.I.A., F.F.A.
Occidental Life Ins. Co., Los Angeles, Cal.
Arthur J. C. Huenergard, B.A., F.A.S.
Commonwealth Life Ins. Co., Omaha, Neb.
Charles Hughes, A.A.S.
Ins. Dept., New York City.
Arthur Hunter, F.F.A., F.A.S.
New York Life Ins. Co., New York City.
Robertson G. Hunter, F.A.S., A.I.A.
Equitable Life Ins. Co., Des Moines, Iowa.

Wm. A. Hutcheson,
Mutual Life of New York, New York, N. Y.
Edward Wyllys Hyde, B.C.E., C.E.
Columbia Life Ins. Co., Cincinnati, Ohio.
Walter Irving King, A.B., F.A.S.
Connecticut General Life Ins. Co., Hartford, Conn.
John Melvin Laird, B.A., F.A.S., A.I.A.
Connecticut General Life Ins. Co., Hartford, Conn.
William Macfarlane, F.F.A., F.A.S.
New York Life Ins. Co., New York City.
Alexander T. Maclean.
Mass. Mutual Life Ins. Co., Springfield, Mass.
James McIntosh, F.F.A.
Minnesota Mutual Life Ins. Co., St. Paul, Minn.
Malcolm McNeill, Ph.D.
Lake Forest College, Lake Forest, Ill.
Erston L. Marshall, A.B., J.D.
323 Kraft Bldg., Des Moines, Iowa.
Franklin Bush Mead, A.B., F.A.S.
Lincoln National Life Ins. Co., Fort Wayne, Ind.
Henry Moir, F.F.A., F.I.A., F.A.S.
Home Life Ins. Co., New York City.
Paul Vaughn Montgomery, B.A.
Fort Worth Life Ins. Co., Fort Worth, Tex.
Edward B. Morris, Ph.B., F.A.S.
The Travelers Ins. Co., Hartford, Conn.
William Oscar Morris, A.A.S.
North American Life Ins. Co., Chicago, Ill.
William Ewart Napier.
Scranton Life Ins. Co., Scranton, Pa.
Joseph Howard Nitchie, A.B., F.A.S.
1523, 19 S. La Salle St., Chicago, Ill.
Bernhard Robert Nueske.
Old Colony Life Ins. Co., Chicago, Ill.
Robert Kelly Orr.
Lansing, Mich.
Percy Charles Herbert Papps, A.I.A., F.A.S.
Mutual Benefit Life Ins, Co., Newark, N. J.
John G. Parker, B.A., F.A.S., A.I.A.
Imperial Life Assurance Co., Toronto, Ont., Can.

George Benjamin Pattison, A.A.S.
Peoria Life Ins. Co., Peoria, Ill.
Oliver Winfred Perrin, B.A., M.A., F.A.S.
Penn Mutual Life Ins. Co., Philadelphia, Pa.
Shaffner Leonard Phelps, B.S.
Volunteer State Life Ins. Co., Chattanooga, Tenn.
Thomas Ashley Phillips, A.B., A.A.S., A.I.A.
Minnesota Mutual Life Ins. Co., St. Paul, Minn.
Sidney Herbert Pipe, F.A.S., A.I.A.
Temple Bldg., Toronto, Canada.
Joseph B. Reynolds.
Kansas City Life Ins. Co., Kansas City, Mo.
Edward E. Rhodes, F.A.S.
Mutual Benefit Life Ins. Co., Newark, N. J.
Henry Lewis Rietz, B.Sc., Ph.D., F.A.A.S., F.R.S.S. (Mem. A.M.S.).
University of Iowa, Iowa City, Iowa.
J. Charles Rietz, A.B. (Mem. A.M.S.).
Midland Mutual Life Ins. Co., Columbus, Ohio.
John Francis Roche, F.A.S.
Manhattan Life Ins. Co., New York City.
George Roslington, F.C.A., A.I.S.
Occidental Life Ins. Co., Albuquerque, N. M.
George White Sanders, A.B., F.A.S.
Michigan Mutual Life Ins. Co., Detroit, Mich.
Jacob Charles Seitz, A.B.
Security Life Ins. Co. of America, 1101 The Rookery, Chicago, Ill.
Andrew Sigtenhorst.
Texas Life Ins. Co., Waco, Tex.
Alexander Albert Speers, B.A., F.A.S.
North American Life Ins. Co., Omaha, Neb.
Calvert Frederick Stein.
Maryland Assurance Corporation, Baltimore, Md.
Bert J. Stookey.
Illinois Life Ins. Co., Chicago, Ill.
Wendell M. Strong.
Mutual Life Ins. Co. of New York, New York, N. Y.
Gordon William Thomson, F.F.A., A.I.A., A.A.S.
West Coast Life Ins. Co., San Francisco, Cal.

Carleton M. Vail, A.B.
 1005, 110 S. Dearborn St., Chicago, Ill.
James H. Washburn, A.A.S.
 165 Broadway, New York City.
William Arthur Watt, M.A., F.A.S.
 Southern Life and Trust Co., Greensboro, N. C.
Robert Montague Webb.
 Kansas City Life Ins. Co., Kansas City, Mo.
A. A. Welch, A.B.
 Phoenix Mutual Life Ins. Co., Hartford, Conn.
Romeo Meran Wilbur.
 549 Railway Exchange Bldg., Chicago, Ill.
Frederick Alfred Williams, F.A.S., A.I.A., F.S.S.
 Apartado 1420, Mexico City, Mexico.
Frederic Scherer Withington,
 402–404 Kraft Bldg., Des Moines, Iowa.
Joseph Hooker Woodward.
 Equitable Life Assurance Society, New York City.
Paul Livingston Woolston, B.S.
 1636 E. Eighth Ave., Denver, Colo.

ASSOCIATES

Albert Babbitt, A.M.
 The Lamar Life Ins. Co., Jackson, Miss.
Henricks Bryant Beach, M.A.
 Provident Ins. Co., Bismarck, N. D.
Benjamin S. Beecher, A.M.
 National Guardian Life Ins. Co., Madison, Wis.
George Walter Bishop.
 The Bankers Reserve Life Ins. Co., Omaha, Neb.
Lester A. Bosworth, B.S., A.A.S.
 Continental Life Ins. Co., Wilmington, Del.
Lorne T. Boyd.
 Northwestern Life Assurance Co., Winnipeg, Canada.
Walter Gregory Bowerman, M.A., A.A.S.
 New York Life Ins. Co., 346 Broadway, New York City.
William Edgar Brimstin.
 Federal Life Ins. Co., Chicago, Ill.
Charles Edward Brooks.
 613 Insurance Bldg., Madison, Wis.

Everett G. Brown.
    Southwestern Life Ins. Co., Dallas, Texas.
Helen E. Brown.
    19 Niles St., Hartford, Conn.
Helmuth G. Brunnquell.
    Ins. Dept., Madison, Wis.
Harold Hibbs Buckman.
    California State Life Ins. Co., Sacramento, Cal.
Charles J. Burkhart.
    Kansas City Life Ins. Co., Kansas City, Mo.
Clarence E. Cale.
    Continental Life Ins. Co., Toronto, Canada.
Helen L. Clark.
    American Central Life Ins. Co., Indianapolis, Ind.
Arturo H. Clement.
    La Mundial Ins. Co., Santiago, Chili.
Wendell Phillips Coler, A.B.
    The Maccabees, 5065 Woodward Ave., Detroit, Mich.
John Alexander Copeland, A.B.
    124–126 Hury Bldg., Atlanta, Ga.
O. A. Ehrenclou, A.A.S.
    Missouri State Life Ins. Co., St. Louis, Mo,
Edward B. Escott.
    Audit Bureau of Circulations, Century Bldg., Chicago, Ill.
Harry C. Fetsch, B.A., A.A.S.
    Ohio State Life Ins. Co., Columbus, Ohio.
Alexander Caldwell Good.
    Great Southern Life Ins. Co., Houston, Texas.
Clarence R. Goodrich.
    State Insurance Dept., Jefferson City, Mo.
Irvin Lorenzo Grimes, A.B.
    Mutual Trust Life Ins. Co., Stock Exchange Bldg., Chicago, Ill.
Robert N. Griswold, A.A.S.
    Inter-Mountain Life Ins. Co., Salt Lake City, Utah.
John V. Hanna.
    United Life and Accident Co., Concord, N. H.
W. J. Hiller, A.B.
    Bankers Life of Nebraska, Lincoln, Neb.

Grady Hayne Hipp, A.B.
    New York Ins. Dept., Albany, N. Y.
George William H. Huskinson.
    1127 Easton St., Alton, Ill.
Wilbur M. Johnson, A.M.
    The Surety Fund Life Co., Minneapolis, Minn.
Frank Russell Jordan, B.A., A.A.S.
    Franklin Life Ins. Co., Springfield, Ill.
Arthur W. Larson, M.A., A.A.S.
    Volunteer State Life Ins. Co., Chattanooga, Tenn.
R. C. McCankie.
    Equitable Life Ins. Co. of Iowa, Des Moines, Iowa.
A. C. McConaghy.
    Continental Life Ins. Co., St. Louis, Mo.
H. C. Marvin, A.M.
    812 Hume-Mansur Bldg., Indianapolis, Ind.
Joseph Duryea Maynard.
    Northwestern Mutual Life Ins. Co., Milwaukee, Wis.
George Myers.
    Missouri State Life Ins. Co., St. Louis, Mo.
Gertrude L. Pardieck.
    State Life Ins. Co., Indianapolis, Ind.
Elder A. Porter.
    Indianapolis Life Ins. Co., Indianapolis, Ind.
Euclid Leonidas Porter.
    Volunteer State Life Ins. Co., Chattanooga, Tenn.
John M. Powell, A.B., A.A.S.
    Columbian National Life Ins. Co., 77 Franklin St., Boston, Mass.
Henry Reichgott, Ph.B., A.A.S.
    Missouri State Life Ins. Co., St. Louis, Mo.
John F. Reilly, M.A.
    University of Iowa, Iowa City, Iowa.
Rainard B. Robbins.
    1113 Ferdon Road, Ann Arbor, Mich.
Stanford Z. Rothschild, A.B., A.A.S.
    Sun Life Ins. Co. of America, Baltimore, Md.
Martin Rowley Scott.
    Royal Union Mutual Life Ins. Co., Des Moines, Iowa.

Henry G. Sellman, A.B.
407 Olive St., St. Louis, Mo.
Clinton O. Shepherd, A.A.S.
Missouri State Life Ins. Co., St. Louis, Mo.
Coll C. Sinclair.
Great-West Life Assurance Co., Winnipeg, Man., Can.
Guy L. Stayman.
Reserve Loan Life Ins. Co., Indianapolis, Ind.
Fred David Strudell.
American Life Reinsurance Co., Dallas, Texas.
Robert B. Sturtevant.
American Central Life Ins. Co., Indianapolis, Ind.
Toshikazu Suzuki, M.S.
The First Mutual Life Ins. Co., Kyobashi, Tokio, Japan.
Verne L. Tickner.
International Life Ins. Co., 331 Fourth Ave., Pittsburgh, Pa.
Roger Sherman Vail, A.B.
1005, 110 S. Dearborn St., Chicago, Ill.
Bernard Werkenthin.
Ins. Dept., Austin, Texas.
Horace Scoville Wiggins, C.P.A.
514–515 Bankers Life Bldg., Lincoln, Neb.
Helen J. Williams, A.B., M.S.
Lincoln Nat'l Life Ins. Co., Ft. Wayne, Ind.
Jens Peter Yort.
Masonic Mutual Life Association, Washington, D. C.

CONTRIBUTING MEMBERS

Aetna Life Insurance Co	Hartford, Conn.
American Bankers Insurance Co	Chicago, Ill.
American Central Life Insurance Co	Indianapolis, Ind.
American Life Insurance Co	Denver, Colo.
American National Life Insurance Co	Galveston, Texas
Amicable Life Insurance Co	Waco, Texas
Atlantic Life Insurance Co	Richmond, Va.
Bank Savings Life Insurance Co	Topeka, Kan.
Bankers Life Co	Des Moines, Ia.
Bankers Reserve Life Co	Omaha, Neb.

Canada Life Insurance Co	Toronto, Can.
Capitol Life Insurance Co. of Colorado	Denver, Colo.
Cedar Rapids Life Insurance Co	Cedar Rapids, Ia.
Central Life Assurance Society	Des Moines, Ia.
Central Life Insurance Co. of Illinois	Ottawa, Ill.
Central States Life Insurance Co	St. Louis, Mo.
Cleveland Life Insurance Co	Cleveland, Ohio
Columbia Life Insurance Co	Cincinnati, Ohio
Columbus Mutual Life Insurance Co	Columbus, Ohio
Connecticut General Life Insurance Co	Hartford, Conn.
Continental Life Insurance Co	St. Louis, Mo.
Dakota Life Insurance Co	Watertown, S. D.
Elkhorn Life and Accident Insurance Co	Norkfolk, Neb.
Equitable Life Insurance Co. of the District of Columbia,	Washington, D. C.
Equitable Life Insurance Co. of Iowa	Des Moines, Iowa
Excelsior Life Insurance Co	Toronto, Can.
Farmers and Bankers Life Insurance Co	Wichita, Kan.
Federal Life Insurance Co	Chicago, Ill.
Fidelity Mutual Life Insurance Co	Philadelphia, Pa.
Forth Worth Life Insurance Co	Ft. Worth, Texas
Franklin Life Insurance Co	Springfield, Ill.
George Washington Life Insurance Co	Charleston, W. Va.
Great Northern Life Insurance Co	Chicago, Ill.
Great Southern Life Insurance Co	Houston, Texas
Great-West Life Assurance Co	Winnipeg, Man., Can.
Guaranty Life Insurance Co	Davenport, Ia.
Guardian Life Insurance Co. of America	New York, N. Y.
Idaho State Life Insurance Co	Boise, Idaho
Illinois Life Insurance Co	Chicago, Ill.
Imperial Life Insurance Co	Toronto, Can.
Indiana National Life Insurance Co.	Indianapolis, Ind.
Indianapolis Life Insurance Co	Indianapolis, Ind.
Inter-Mountain Life Insurance Co	Salt Lake City, Utah
International Life Insurance Co	St. Louis, Mo.
Iowa Life Insurance Co	Waterloo, Iowa
Jefferson Standard Life Insurance Co	Greensboro, N. C.
John Hancock Mutual Life Insurance Co	Boston, Mass.
Kansas City Life Insurance Co	Kansas City, Mo.

LaFayette Life Insurance Co	LaFayette, Ind.
Lamar Life Insurance Co	Jackson, Miss.
Lincoln National Life Insurance Co	Ft. Wayne, Ind.
London Life Insurance Co	London, Canada
Maryland Life Insurance Co	Baltimore, Md.
Massachusetts Mutual Life Insurance Co	Springfield, Mass.
Merchants Life Insurance Co	Des Moines, Iowa
Metropolitan Life Insurance Co	New York City, N. Y.
Michigan Mutual Life Insurance Co	Detroit, Mich.
Midland Life Insurance Co	Kansas City, Mo.
Midland Mutual Life Insurance Co	Columbus, Ohio
Minnesota Mutual Life Insurance Co	St. Paul, Minn.
Missouri State Life Insurance Co	St. Louis, Mo.
Montana Life Insurance Co	Helena, Mont.
Mutual Benefit Life Insurance Co	Newark, N. J.
Mutual Life of Illinois	Springfield, Ill.
Mutual Trust Life Insurance Co	Chicago, Ill.
National Guardian Life Insurance Co	Madison, Wis.
National Life and Accident Insurance Co	Nashville, Tenn.
National Life Insurance Co. of the U. S. of A	Chicago, Ill.
National Life Insurance Co	Montpelier, Vt.
New England Mutual Life Insurance Co	Boston, Mass.
North American Life Insurance Co	Chicago, Ill.
Northern Assurance Company of Michigan	Detroit, Mich.
Northern Life Insurance Co	Seattle, Wash.
Northwestern National Life Insurance Co.,	Minneapolis, Minn.
Occidental Life Insurance Co	Los Angeles, Cal.
Ohio National Life Insurance Co	Cincinnati, Ohio
Ohio State Life Insurance Co	Columbus, Ohio
Old Colony Life Insurance Co	Chicago, Ill.
Old Line Life Insurance Co	Milwaukee, Wis.
Pacific Mutual Life Insurance Co	Los Angeles, Cal.
Pan-American Life Insurance Co	New Orleans, La.
Peoples Life Insurance Co	Chicago, Ill.
Peoples Life Insurance Co	Frankfort, Ind.
Peoria Life Insurance Co	Peoria, Ill.
Phoenix Mutual Life Insurance Co	Hartford, Conn.
Philadelphia Life Insurance Co	Philadelphia, Pa.

Provident Life and Trust Insurance Co.....Philadelphia, Pa.
Prudential Life Insurance Co. of America.....Newark, N. J.
Public Savings Life Insurance Co. of America, Indianapolis, Ind.
Register Life Insurance Co................Davenport, Iowa
Reinsurance Life Company of America....Des Moines, Iowa
Reliance Life Insurance Co.... ....Pittsburgh, Pa.
Reserve Loan Life Insurance Co..........Indianapolis, Ind.
Royal Union Mutual Life Insurance Co.....Des Moines, Ia.
Scranton Life Insurance Co........ ....Scranton, Pa.
Security Life Insurance Co. of America........ Chicago, Ill.
Southland Life Insurance Co.................Dallas, Texas
Southwestern Life Insurance Co..............Dallas, Texas
Standard Life Insurance Co..................St. Louis, Mo.
State Life Insurance Co..................Indianapolis, Ind.
Travelers Life Insurance Co...............Hartford, Conn.
Two Republics Life Insurance Co............El Paso, Texas
Union Central Life Insurance Co...........Cincinnati, Ohio
Volunteer State Life Insurance Co......Chattanooga, Tenn.
West Coast Life Insurance Co...........San Francisco, Cal.
Western Reserve Life Insurance Co............Muncie, Ind.
Western States Life Insurance Co.......San Francisco, Cal.
Western Union Life Insurance Co...........Spokane, Wash.
Wisconsin Life Insurance Co.................Madison, Wis.
Wisconsin National Life Insurance Co........Oshkosh, Wis.

DECEASED MEMBERS

Carroll Booth Carr
Horton Woods Cochnower
Isaac Davenport
John Maynard Emery
Virgil Morrison Kime
Louis Linzmeyer
Lucius McAdam
Nels Nelson
Albert Garfield Portch
Henry Sherman Vial
Geert Andrier Vander Sluis
Harris Eli Vineberg
Benjamin A. Welstead
Wilbur Sylvester Wynn

ADDRESS OF THE PRESIDENT,

LAWRENCE M. CATHLES

It is the duty of your President to preside at all meetings; to give, for the information and approval of the membership, a summary of the business transacted by the Board of Governors since the last meeting; and to indicate, with what skill and judgment he may possess, what direction in his opinion the future activities of the Institute should take.

This last is by far the hardest part of the President's duties. Our main lines of activity are fairly well known—I offer here only a few thoughts which may not have occurred to the majority of our members.

Our constitution declares that the object of the American Institute of Actuaries is to advance the science of insurance mathematics and the knowledge of the theory and practice of life insurance and related interests, by associating together persons of like interests. By adding the words "and related interests" it seems that the framers of our constitution intended that our activities should not be strictly limited to life insurance. These words would then include such fields as political economy, finance and legislation, so far as these affect our business.

The foundations of the world were shaken by the Great War. The same amount of land and water remains, and within reasonable limits we know approximately how many men, women and children exist thereon; but I do not believe we yet know whether the world's financial structure and industrial system is intact, or whether changes are yet to come which will more or less directly affect the business of life insurance as now conducted. So far as my information goes, the life insurance business has stood the test of both war and pestilence, though in some countries the payment of the face value of policies in a greatly depreciated currency, while completely fulfilling the company's legal obligations, must have been very disappointing to the beneficiaries. Comparisons of net cost of policies sink into insignificance in the consideration of violent fluctuations in the purchasing power of their proceeds at maturity, such as we have witnessed during the postwar years.

It would interest insurance men in this country to know just what has happened to the insurance business abroad. The language difficulty is great, and the disorganization of business and governments abroad may also be very great, but I do not believe they are insuperable. I hope that some of our younger members who are gifted in languages or may have specially favorable connections will investigate this subject and give us the benefit of actually learning how life insurance has stood the test.

Mr. Graham, in a recent presidential address, urged that our younger members should regard qualification by examination in this Institute as a means to greater service rather than as an end in itself. There is no better way for any man or woman to obtain a thorough knowledge of the fundamental truths of the business of life insurance than by taking actuarial examinations; but the life insurance business is a jealous mistress, and the actuary perhaps more than any other officer is under the constant temptation to become completely absorbed in his own particular branch of the business.

This should not be so. The demand for actuarial assistants has been great and seems to be still in excess of the supply; and there are fields of usefulness for them in our companies scarcely yet touched. They are needed in the investment, legal, accounting and agency departments. I think that very generally they are already in close cooperation with the medical departments of our companies. I do not think there is any department of our companies which would not be benefited in actual everyday work—both executive and administrative—by having closely associated with it a thoroughly qualified actuary specializing in its work.

It has been the custom of some life insurance companies to offer bonuses or special increases in salary to members of their staffs successfully passing examinations in a recognized actuarial body. I suggest to members of our Institute who are the actuaries of their companies, that it would not be difficult to show their associates in the management that such a plan would result in benefits to their companies far in excess of the comparatively small amounts required to greatly stimulate interest in the study of the fundamentals of our business.

I want to go a little further if you will bear with me. One of the most intelligent and responsible insurance journals reproaches life insurance companies with the ignorance regarding the life insurance business which it claims exists in the minds of the public.

I believe that most actuaries are good citizens, with more than the ordinary realization of their duties to the community in which they live. It may be that we should put ourselves forward with less reserve in the various activities of our communities so that we will have opportunity from time to time to tell our friends and neighbors more about this great and beneficent business of which we are a part. I believe that if you consciously take such a position you will find unexpected ways of increasing your value to your community.

Just one indication of what I mean: Has your city yet tackled the question of "Pensions to its police and fire department?" Is it ignorantly obligating itself for payments of unexpected and terrifying proportions? An interview with the Mayor or some friend on the city council might save your community great embarrassment without soliciting employment for yourself or others as advisor on technical matters.

A concerted effort by trust companies in various parts of the country to obtain for themselves the supervision and distribution of payments by life insurance companies has made itself evident. I think we are all anxious that every safeguard possible should be placed around the proceeds of our insurance policies so that the great benefits with which the insured expected these policies to bless his beneficiaries shall actually be guaranteed to them. I would like to hear discussed, pro and con, "The Advantages of a Trust Company's Administration of Insurance Benefits" and as to whether the apparently larger return promised by these trust companies is a sufficient offset to the greater security and permanence guaranteed by the life insurance company.

DISCUSSION

A REVIEW OF SOME OF THE EARLIER METHODS OF SURPLUS DISTRIBUTION, SOME PROPOSED METHODS, AND SOME METHODS CURRENTLY IN USE BY LIFE COMPANIES IN THE UNITED STATES

By J. Charles Rietz

Mr. Arthur Coburn: I received the paper on Monday and have had little time to prepare a discussion, but I am going to try to discuss it.

There is a misprint in a formula on page 106; perhaps Mr. Rietz would like to correct that in his reply to the discussion.

I really believe, Mr. President, this is a good paper. I think it is thoughtful and thorough.

In the distribution of surplus it is not possible to obtain absolute equity in all cases between benefit and contribution. Are you going to differentiate between the mortality you experience in different parts of the country, the lapse rate you experience in different sections and the interest rates you have realized on policies of old issue and recent issue? I don't think it is possible. I think you ought to make a simple distribution.

The policyholders expect about an even progression in dividends. I believe the payment of extra dividends is a source of trouble because when a member receives a dividend of $5, then one of $15, then one of $5.50, he doesn't understand it; and you will consequently have much correspondence.

I think the system of distribution ought to be flexible. Interest rates fluctuate; the tax rates constantly increase; the mortality rate fluctuates; therefore I think a company in designing or modifying a system of distribution should make it susceptible to change to meet altered circumstances.

The more I look into this subject of distribution the less inclined am I to take sides. I used to feel that the only system of distribution was a 3-factor system; I am not at all sure today whether that is true.

I think the description contained in the paper of what a number of companies are doing is valuable. I noticed that in one of the companies, not using a full level premium valuation, the loading used in order to obtain the gain from loading is the difference between the gross premium and the level net premium. I am rather surprised at that. That is not a criticism; I merely mention it as an example, because I have thought that it was very much simpler for the company that had a preliminary term valuation to take care of the matter of expenses than one which used a level premium valuation.

I wish that some of the members who have had some experience along that line would discuss this.

MR. C. O. SHEPHERD: I have a few notes on the question of policy dividends; perhaps I may be subject to criticism in not following the title of the paper as closely as I might.

Mr. Rietz's paper, I presume, was written primarily for the benefit of the student and I am sure will be warmly welcomed for the manner in which he has assembled almost inaccessible material, while pointing out the more important developments of the subject.

Actuarial literature on policy dividends is not lacking. The subject has been much discussed, but very few of the discussions have treated it in a way to meet the needs of students. Most of the papers presented have dealt with the problem not in a general way but as closely related to certain fixed conditions, devoting little space to the nature of the problems involved. In this branch of actuarial science we have been very practical.

A noteworthy exception is the paper of Mr. Homans describing his contribution formula, a bold conception and a keen analysis which we have improved or elaborated but little in the sixty years following. George Hardy, in discussing one of the papers before the British Institute in 1896, called the American contribution plan highly scientific. It is appropriate, therefore, that our Record should preserve the opinions of early American actuaries regarding it.

The acceptance of the principle of the contribution method by no means disposes of the problem of surplus distribution. The equitable distribution of surplus to policyholders will always be difficult, because it depends directly on the solution of such questions as the proper assessment of expenses, construction of premium rates, and methods of valuation, each in itself a difficult problem. A logical and clear solution of these questions will make the distribution of surplus a comparatively simple matter, because a policy dividend is fundamentally a refund in adjustment of premium charges.

If premium rates have been constructed from the company's experience to meet a carefully estimated scale of expense and a definite rate of mortality at a given rate of interest, then a comparison of actual costs with anticipated costs is possible, and an important step will have been taken. Few companies, more particularly among the more youthful organizations, have been able to proceed so scientifically. The expense ratios in the younger companies have not become stabilized, and mortality experience in most cases has been insufficient in amount, and as a consequence the rates have been determined largely by competition.

Actuarial thought, though active in many lines in this country during the past quarter of a century, has been handicapped in the study of this problem, not only on account of changing conditions, due to the rapid growth of our companies, but also, I believe, to the lack of a suitable mortality standard. In early life insurance history of this country we were dependent upon British experience for our mortality table, and if the American Experience table was an improvement, it had already lost some of its virtues as an accurate measure of mortality by the time it was generally adopted. Not until 1918 did we have a general table reflecting recent mortality on insured lives in the United States, nor until then did we have any reliable measure of the effects of our selection, a major factor in the rate of mortality. I believe that the direct use of a select mortality table in the computation of premium rates, and surplus distribution, has become indispensable. I do not think a general offsetting of mortality savings due to selection against certain expenses is to be commended.

So long as we express our gross premiums in terms of the American Experience, net premiums and loading, just so long shall we multiply our difficulties in apportioning dividends.

We have a much more useful standard in the American Men Table, and the more generally we can adopt it in our work as a standard of reference the better progress we shall make against the problems we face.

On the subject of scientific construction of premiums for life insurance, which as I have said is a prerequisite to the scientific distribution of surplus, I have seen nothing so satisfying as the paper on "Premiums for Non-Participating Life Insurance" by E. E. Cammack, read before the Actuarial Society of America in October 1919. While the title refers to non-participating insurance, obviously the same principles apply to participating premiums.

One of the most troublesome problems in the assessment of expenses, and, therefore, in surplus distribution, involves the theory that old policyholders may properly be charged with part of the cost of new business because new business is necessary to the life of the company. I am inclined to agree with the theory so far as new business can not be made to pay for itself, but I believe the nearer we can come to the point where the premiums received for new insurance meet the expenses attributable to its acquisition, the sounder our insurance structure will be. Rufus Weeks set himself the standard of equity that every policy shall receive the same treatment as if the entire company were made up of identical policies. He might, also, have added that the amount of surplus apportioned to a given policy shall not be affected by any reasonable change in the proportion of new business written. The latter requirement could hardly be met under present conditions with a net level premium valuation. If such a standard is proper, wherein does the fault lie?

Without any attempt to criticise a method which has proved itself so practicable, we may ask whether a net premium method of valuation is strictly logical. Our gross premiums are computed in anticipation of certain yearly costs, divided naturally into mortality and expenses. Why have we dealt with these two kinds of costs so differently? Incidence of expense is just as important as incidence of mortality, and, except as a matter of convenience and ease of computation, there is no occasion for the construction of a net premium as an intermediate step.

Having computed our premiums on such assumptions, why should we not adopt those assumptions as to incidence of expense as well as mortality in determining our reserve? Obviously such a method of computing reserves, while perfectly sound mathematically, is not practicable for reasons too numerous to mention. On the other hand, our net premium method of valuation is not logical because it assumes that expenses for all policy years are equal—which we know to be not in accordance with the facts. It is in sacrificing logic to practical considerations that we have introduced inconsistencies, which are our greatest source of difficulty in surplus distribution. Our modified preliminary term method may be considered a partial recognition of the principle I have mentioned above.

I have said that many of the papers presented on the subject of policy dividends have dealt with very specific rather than general problems. A case in point, I believe, is the controversy as to the relative merits of the two and three factor methods. So far as I know there has been no dispute as to the correctness of the principles involved in the contribution formula, which might be described as a three factor formula, though in the controversy we are discussing a three factor formula had a more specific definition. Between the proponents of these two methods there is no argument as to the results to be obtained, or the criteria of a satisfactory distribution. The question is rather as to which algebraic formula produces those results for various ages and plans with the greatest accuracy. The trouble, therefore, is not a general one, but one depending entirely upon the peculiar differences between actual rates of mortality and actual rates of interest, and actual expenses and rates of mortality and interest required, according to our logical standards and expenses assumed in the computation of our rates.

Mr. Buttolph: Mr. Chairman, I want to express my regret that such a one as Mr. Coburn should have a doubt as to the possibility of making an equitable distribution of surplus. I feel that he attaches to that expression a rather strained meaning. Is a stockholder in an industrial concern inequitably treated merely because, living in a city and state where the company does a large and profitable business, he receives no greater dividend on his stockholdings than does one living in a city and state where the company's business is smaller and hence less profitable?

The theory that in order to effect equity as between policyholders it would be necessary to take into consideration a more or less favorable mortality experience in the state in which that policyholder resides, if carried to a logical conclusion, would have to narrow down to the consideration of the mortality in his city or in his ward, or in his block.

It seems to me that a participating policyholder is, to speak somewhat loosely, perhaps, in the position of a member in a mutual cooperative association. He is just as much bound to see justice done in carrying out the contract in a far distant state as he is in his own state.

I believe that we can not afford to admit that equity requires so narrow a view of the exact geographical location of the place where the greatest profits arise.

MR. I. S. HOMANS: Mr. President, it has always seemed to me rather strange that the older a policy grows the larger the dividend is.

Theoretically the contribution formula is perfect. It takes into account the three main divisions of a premium. But take a policy thirty-five or forty years old getting a dividend of 50 per cent, 60 per cent, or 75 per cent of the premium, it doesn't seem equitable. The biggest factor in high premium and old policies is reserve, and the interest factor proper produces the largest part of the dividend and, necessarily, if the formula is followed closely and directly, the dividend is bound to be greater. But it can be obviated by throwing interest either into expenses or mortality.

I have often wondered why—because dividends after all are a very practical proposition—why we don't attempt individual equity, which is general equity.

The old men don't contribute more; in fact the mortality at the older age is greater.

I should think the most equitable procedure would be in some way to throw the interest into the mortality or loading.

MR. E. L. MARSHALL: Mr. President, Mr. Rietz's suggestion that the company who has not had sufficient mortality experience of its own to form a basis for distribution of dividends might follow as somewhat of a guide the A.M. tables, graduating the percentage of the American Experience so as to follow approximately the American Men mortality, gives me an opportunity to make one remark I might have made if there had been a discussion at this meeting of my paper given at the June meeting. That is, that in applying that method with two companies, both of which had dividend clauses that were so especially worded as to seem to require the use of all three factors in the distribution, I found that it produced a distinct irregularity in the dividends. In one of these cases I used a graded percentage of mortality and in the other I used a percentage (above 100 per cent) of the A.M. table, applying in each case the assumed mortality at the attained age to the net amount of risk to get my actual mortality cost. I found, especially in the latter case, that the dividends were not practical unless I either varied my loading factor at different ages or made my calculations for the particular ages which would be practical and interpolated between them.

I mention this simply as an emphasis of the importance of not waiting to value by the A.M. tables until required to do so by state law, and as showing the advantages both of making up our statement and valuation by the A.M. Table ourselves, and also of calculating our gross premiums with reference to that basis.

Undoubtedly the reason for the irregularity was due to the fact that the reserves and premiums which were used were on the American Experience, while the actual mortality was following such a radically different curve. If we had our rates and reserves on the A.M. tables we would not have experienced that difficulty in that case.

Frequently it has been indicated that the importance of basing our rates on the A.M. tables was chiefly in the case of non-par companies, and some have indicated there was not that importance present for participating companies. But I think that here is one point as to the use of the A.M. tables for premiums and reserves that is of peculiar benefit to the participating companies.

Mr. L. A. Anderson: I agree with Mr. Buttolph. It is impossible to take into account the different mortalities of different states, or even the oldest states. You can easily speak of a company that has only a few policyholders, operating for a number of years with comparatively few losses, then in one year having a loss of about two or three hundred per cent.

I think there is only one factor that can be taken into account in distributing dividends and making a distinction between state and state: that is the taxes. That has been tried out by at least one company, but they abandoned it.

It seems there is one point we should work toward; that is to make the net cost under the different plans somewhat consistent. It doesn't seem right, for instance, that at the end of ten or twenty years under one form of policy the net cost should be much more than for another form. As an example, compare the twenty-year endowment and the twenty-payment life.

In most companies the loading is very unequal between those different plans. If you want to talk equity in America, I believe you must recognize that difference in loading so as to make the net cost consistent.

MR. J. CHARLES RIETZ: On account of not being here at the beginning of this discussion, I shall have little to add to the discussion.

This paper will have fully served the purpose that I intended it to serve if it is useful to students of the Institute, and if it provokes discussion of this general subject of surplus distribution. It is a subject in which I have been very much interested. I have been interested in knowing what companies are really doing in the present day, as well as what they have done in the past. It was for that reason that I made some effort to investigate what companies are doing, with the desire to pass it on to students in the form of this paper. I realize the paper's shortcomings, and that it really doesn't contribute anything new to the subject in the usual meaning of the word. It consists very largely of quotations.

I wish to thank Mr. Coburn for calling attention to the misprint of the formula on page 106. I cannot account for that being overlooked in reading the proof. It is very evident that the formula should be:

$$I_m = [(1 + i)^n - (1 + i')^n] \cdot V_{m-n}$$

INFORMAL DISCUSSION

CONSERVATION OF BUSINESS

(*a*) The consideration of the discontinuance of an old policy, the assured to take out a new contract limiting the number of premiums to the premium-paying period of the old contract, or limiting the amount of the policy to the face value of the contract less any loan standing against it.

(*b*) Should any modification be made in the usual rules for changing policies from higher to lower premium plans, or in the reduction of policies, particularly before such policies have acquired cash values?

(*c*) The problem of the "Twister" and "Insurance Adviser." The best method of handling their statements.

(*d*) Evidence of insurability required for change of plan.

(*e*) Adjustment of commissions in case of change.

Mr. W. A. P. Wood: Mr. President, ladies and gentlemen: I am afraid that I am not in a position to deal as fully with this subject as some of the other members here are, for the reason that we don't have all the problems to deal with in Canada that you have in the United States, although we have enough of them.

Reference has been made to the treatment of the policyholders in the hospital. If owners of lapsed policies are referred to in this way, then I suppose that the first section in our programme dealing with the conservation of business might come under the classification of "preventive medicine." The duty of the doctor should be to prevent the patient from becoming ill rather than the treatment of the patient after he has become ill. The latter, I think, would come under the second section, "Reinstatement of Lapsed Policies."

Sub-section (*a*) of the first section as you have it here in the programme is one that I think we don't have to deal with very much in Canada, because I understand it is intended chiefly to cover the work of the insurance adviser; although in some cases I suppose we might have it within the Company itself, in which case there would be no additional expense in connection with it.

I must confess that I do not think it is very satisfactory in dealing with policyholders who are contemplating letting their policies lapse, to allow them the cash surrender value to be used to purchase another policy at the attained age. There are cases in which this might perhaps be done. There are cases no doubt in which there is a large loan against the policy, and in such cases we have at times reduced the amount of insurance. If the loan against the policy was fifty per cent of the cash value of the policy, then upon request of the policyholder we have agreed to reduce the insurance by one-half and allowed the insured to go on paying one-half of the premium. But I think in a great many cases this is not necessary. The better way to handle this situation, to my mind, is to get after the policyholder to repay the loan. I know a great many of the companies do not insist on repayment of a loan in a single payment, but will accept small payments from time to time, and in that way they are helping to conserve the business.

The next sub-section is, "Should any modification be made in the usual rules for changing policies from higher to lower premium plans, or in the reduction of policies, particularly before such policies have acquired cash values?"

It is somewhat difficult to answer that question intelligently without knowing the practice of a large number of companies. I have made a few notes with regard to the practice of the company with which I am connected, and perhaps I may just as well give them to you now.

Let us take first a policy on which less than three years' premiums have been paid but which has been in force more than three months. If there has been a change in plan calling for a difference in premium, we allow the assured the difference in premium less the difference in commissions. Now, in this connection there has been a problem which has caused us some trouble. Until recently our practice was a little more liberal to the assured, and we allowed him the full difference in premiums and we charged the difference in commissions up to the agent. But in making this charge against the agent we found that we were getting into trouble. There was, of course, the question of the legality of the matter. Where an agent wrote a policy a year ago in good faith and collected his premiums, had we any right to go back and make that agent forfeit the commissions on the difference in premiums simply because the assured was not able to continue his policy as put on the books in the first place? In many cases it was claimed that the business was properly sold, and that the change, being due to a change in the circumstances of the assured, the agent should not suffer therefor. We pointed out that if something was not done about it, the policy might lapse altogether and there would be no renewal commissions thereon. While we were able in some cases to convince the agent that our practice was all right, we were not successful in doing so generally; and we thought in order to have uniformity of practice that we would have to charge the difference in commissions to the assured. If the sum assured is also being reduced we have been allowing the assured the difference in premiums less the difference in commissions and less the term insurance on the amount cancelled. When a policy has been three years in force, that is, when it has come to the point where there would be a cash surrender value we have been allowing the assured the difference in the reserves or the difference in the cash surrender values.

In cases where the sum assured is reduced, the plan not being changed, and where the policy has been less than one year in force, we have been allowing the assured the premiums paid on the amount cancelled, less the term insurance and less the commissions on the amount cancelled. If two and one-half years' premiums have been paid we have allowed the assured the third year cash surrender value less the half-yearly premium. This applies to companies that do not grant cash surrender values until the end of the third year. Now those companies that have a cash surrender value at the end of two years perhaps would want to make an adjustment after premiums for a year and one-half have been paid.

Another part of the topic mentioned here deals with the "Twister" and the "Insurance Adviser." As far as the twisting is concerned we have perhaps a certain amount of that by rival agents, but I don't think a very great deal of it, and the "Insurance Adviser" is unknown to us; but for you here in the United States I believe he is one of your big problems. It doesn't seem reasonable to think that a profitable change could be made for policyholders generally by these insurance advisers, since they must get their commissions on the policies changed. Surely the original issuing company could afford to do much more for the policyholder than another company could do when the original company has no commissions to pay such as the insurance adviser receives from the other company.

With regard to that part of the topic dealing with "Evidence of insurability required for change of plan," it seems to me that we could be a little more lenient in dealing with such cases than with new cases. Some of the companies in Canada are writing insurance for small amounts, generally not exceeding two thousand dollars, without any medical examination at all. They have in use a questionnaire which is rather exhaustive, going thoroughly into the family and personal history and the habits of the applicant. I believe that in many cases the questionnaire could be used in connection with applications for changing a policy to a lower premium policy where the change in the net amount at risk is small. A short form medical report might be used if the change in the net amount at risk lies between two thousand and five thousand dollars, and the regular full medical report could be used where the amounts involved are larger. This same practice might be followed in connection with the reinstatement of policies, although I presume that most of the companies transacting business in the United States would want the full medical report if a policy had lapsed for a considerable length of time, say four or five years.

I am afraid that I have unintentionally wandered off to another subject, but just in connection with the changes, while I am on that topic I might say that in changing from the higher premium to the lower premium policy, perhaps a little less severe medical test could be made than in your ordinary first examination.

To cover another point in connection with the changes, I might say that in making changes from a higher premium policy to a lower premium policy if there is any refund made, I think it is advisable to have that refund applied to the reduction of future premiums rather than to make a cash refund to the assured. Perhaps if there is a change in the plan and a change in the amount of insurance as well, there may be a sufficient allowance or refund to pay two or three premiums, but don't give it all in one sum. There are some who think it might be well to spread it over even a longer period than three years, but in any event do not make the payment in one sum. I think in this way you will be enabled to conserve the business better.

The conservation of its business is very important to any insurance company, and the foregoing are some of the things which have occurred to me in connection with this particular topic—a topic which seems at the present time to be giving a good deal of concern to all our companies.

A MEMBER: The suggestion was made here that if a man reduced his policy it would not be any different than if he had two policies and dropped one.

MR. WOOD: Suppose he had but one policy and dropped it entirely. I think that man would hardly get as much consideration from the company as would the man who was making the double change, changing the plan and changing the amount. If a man was dropping his policy after it had been in force two years he would simply get nothing, whereas if he were making the premium change we would try to make him an allowance.

MR. BLACKBURN: It is not often that I venture to make any suggestions to my friends the Actuaries, and I think the suggestion I have in mind applies more particularly to the managerial department, and relates to loan values resulting in policy lapses.

I believe Mr. Reynolds showed that investigation of this subject revealed that about 54 per cent of the policy loans resulted in policy lapses. And I got to thinking that some plan should be devised by which that percentage might be reduced somewhat; and as I moved about among the people here and there I made up my mind that the average man who borrows upon his policy after a time begins to regard that loan as a dead horse, just as he does some other debts that he contracts, and loses out entirely.

So it seems to me that the policyholders need to be educated up to the fact that this money that they have borrowed is money that belongs to them, and that they borrowed it from themselves, and that it should be repaid.

Along that line of thought I suggested to one company that a form letter be sent out to each of the borrowers, reading about like this, addressed to the policyholder in person, and signed by the proper officer of the company:

"Your loan is carried by the company as a courtesy to you. This letter is not a demand for payment, but it is noted that you have not reduced the loan. This leads the company to advise you that any sum that you wish to pay at any time will be accepted and credited on your loan. You intended to repay it, you borrowed it with that intention, and the company wishes to be helpful in any way practical, and will credit you with any payment, however small. You are also advised that when you check money out of one bank and deposit that same money in another bank, you have simply changed the money from one pocket to another, and any money that you apply on your loan here is just like checking money from one bank and putting it in another; or like putting money from one pocket to another."

It occurred to me that this might be a means of educating the policyholder up to the fact that when he repays the loan he pays it to himself, not to the company.

MR. E. G. FASSEL: There are some thoughts in connection with this subject that I would like to express. With reference to issuing new policies to replace old policies that are burdened with loans, I do not think that in our company we would be disposed to go to our loan file, pick out cases with fairly heavy loans and write to those policyholders to take out new policies. A man with a policy does not usually care to make any change and would look upon any change suggested by the company with a great deal of suspicion. It would be hard to explain to such a man that what you were doing was for his benefit. But I think if a policyholder wrote in to surrender his policy and take out a new one, and had figures showing that it would be to his advantage to make such a change, we would be disposed to issue him a new policy.

There are a number of methods of combating the practice of replacing an old policy with a new policy with the thought that a high rate of interest on the surrender value of the old policy will help pay the new premium. One obvious argument is to question the stability of the new investment. If the policyholder says he is going to get a high return on his money, answer by telling him of the great experience of insurance companies in the investment of funds, and that he, not having that experience, should not court the danger of losing his money.

A suggestion in the case of a third party seeking to upset a policy is to tell the policyholder that undoubtedly the third party has some ulterior motive, that the "Twister" is going to make money at his expense.

With reference to part (*b*) of the question being discussed, some companies have rather a stern rule in connection with changes to a lower premium plan. If a policyholder started with a policy that had a fairly heavy premium, and then wanted to change it to a policy of lighter premium, the attitude is that the policyholder made a contract with the company which he is failing to perform. He must therefore lose whatever benefit he had under the higher premium policy and forfeit what he paid in. This is in the case of change before a cash value has been acquired. A twenty-year endowment policy with two years' premiums paid would be changed to, say, twenty-payment life by making up two premiums on the new policy as paid and continuing at the new premium rate. This practice seems rather severe. The basis that Mr. Wood gave will, I think, be very satisfactory for such changes.

Under (*c*) I wish to refer to a paper given by Mr. Thompson before the Actuarial Society this Spring. He points out that a change to a lower priced plan involves a decrease in the reserve. This change in the reserve measures the increase in the net amount at risk. The nature of evidence of health requirements may properly be based on the difference in reserves.

MR. W. NELSON BAGLEY: It seems to me that in entering into a contract for life insurance with an individual, the company is also entering into a moral obligation to look intelligently after the life insurance of that individual. And I think also that the initiative in advising the assured when such advice seems necessary should be taken by the company whenever possible.

Now, applying this principle to these several questions, and speaking solely with reference to non-participating insurance: there are many cases depending upon the policy form, on the per cent of the cash value that has been loaned, the age of the policy, and the age of the insured, as to whether it is cheaper and really better for the insured to take out a new policy on a lower premium form, or a new policy at present age on the same premium form, than it is to continue the old policy with the full premium and the loan interest, leaving him only the net difference between the face value of the policy and the loan as his actual insurance.

Except for the difference in rates of interest, it is the same whether the insured has taken a loan from the bank or an individual. The company does not know that, except in case of loan under the policy, and the circumstances in each case must be considered separately. I believe when a policy that has a loan against it has lapsed the company should then advise the individual what is best for him to do. In that case the expert insurance adviser will be forgotten to a great extent.

In the matter of changes. Should any modification be made? I think in some cases improperly so, but in most cases I think the insured is really honest and is seeking to get the thing he has paid for. If he should have a lower premium form policy I don't think there is any question as to the fact that he should have the insurance, and I think it is up to the company to change that policy, without of course exceeding the limit of insurability. And in most cases I think the difference in commissions will be borne by the agent who is sincerely looking after his client's interest. It must be borne in mind that the company can not act against sound business principles, but I think it can go to a greater extent of liberality in dealing with such cases.

The problem of the "Twister" and the "Insurance Adviser." As to the "Twister" pure and simple, it strikes me that if an application for new insurance is made to replace insurance in another company, even if there is only slight suspicion that the "Twister" has a hand in it, the company should decline the application and advise the other company of its action. If it appears that the insured has gone to another company and wanted to change his insurance, and that company has not seen fit to do so, and the other company knows nothing about it, I think the new application should be declined irrespective of any arguments presented by the agent.

Questions (*d*) and (*e*) I think I have answered generally. Now here is a man, for instance, who took out a twenty-year endowment policy six months ago, but now has changed in circumstances and needs money. He likes the insurance, so why not term insurance? Apparently he is all right physically, so why require him to sign anything but a certificate of health? Why make him stand a medical examination? On the matter of commissions it strikes me that the agent could be shown that it is to his interest to make up the difference in the long run in order to conserve his business.

I think these principles apply also to reinstatements. The company, to my mind, is fully justified in being liberal in all respects with reference to retaining the insurance it has on its books, as long as it can do that without impairing its business. And that may be said in a different way, by saying that the people in the Home Office, and particularly those in the actuarial department, must be better salesmen than any others in the organization.

MR. CHARLES HARRISON BECKETT: It is my own conviction that policyholders should be encouraged to keep paid-up participating policies and not surrender them and take out new insurance. The dividend together with the annual increase in cash value of such policies should approximate 4 per cent of the cash value, so the insured has a fairly good investment in addition to insurance protection for the difference between the cash value of his policy and the face thereof. The larger cash value which he could receive later on in life, if all need of insurance protection has passed, will oftentimes be of very great value to him. In this thought I, of course, have in mind the fact that so many people make poor investments when they become advanced in age, and not infrequently the cash value of their paid-up life insurance policies saves them from considerable distress.

In Mr. Blackburn's remarks I understood him to say that he suggested a form letter in reference to policy loans as a favor to the policyholder. We should be very careful to avoid any such statement, for the policy loan is one of the insured's privileges in the contract.

There have been volumes written on the danger of policy loans. It is a subject that is always before us. Undoubtedly many policyholders have been able to continue their policies by use of loans who otherwise would have lost their insurance entirely. However, there is no question but that more insurance is lost through policy loans than has been saved, and this is due to the fact that the policy loan provision has been made use of by policyholders for purposes other than simply paying insurance premiums.

I believe that any policyholder who assigns his policy for loan should have a carefully written letter explaining to him clearly that he has placed his insurance in jeopardy and advising him to repay the loan as soon as he can do so.

Oftentimes the partial payment plan will appeal to the insured.

When the loan is made the company has a good reason for writing the policyholder a high class sales letter, the purpose of which is to give him a deeper appreciation of his insurance.

A MEMBER: The company with which I am connected has a clause in its application asking the applicant whether any other insurance is to be dropped in connection with the new application. And the same question is put to the agent. When we find that the policy to be taken out replaces one which is to be dropped, we decline to issue.

It seems to me that if other companies would do likewise we could set aside the "Twisters."

MR. MCBRIDE: I want to make these remarks at this time because they follow the line of Mr. Bagley's remarks with reference to the "twisters." I have been persuaded by some of my own experiences that we are thinking of the "twister" too much as a matter of ethics, and not enough as a matter of business expediency. We don't want twistable policyholders, and a man whose application comes to us as a result of twisting, whether that is inspired by our agent or not, we will not accept because he is likely to be an unsatisfactory policyholder.

I furthermore believe that such measures as we adopt for the correction of this evil are too frequently taken only when complaint is made. One of the previous speakers suggested putting a question in the application inquiring of the applicant whether other insurance is to be dropped upon policy being issued on the application; and also securing a report from the agent. I think we have some other and better means of regulating that.

Our inspection reports, more extensively recently than formerly, make a showing as to the dates and number of times that the subject has been reported, and if we should find on investigation that our policy is to replace other insurance, we should decline it. From the reports we receive showing recent applications to other companies, our suspicions should be aroused at least to such an extent that we may run in safe directions. We don't like to have our agents fool away their time to lapsers.

Of course we can not always know accurately from the application what other insurance the applicant may be carrying at the time, but if he has omitted mention of it because it is his purpose to discontinue it, we have our warning.

It is very noticeable that a good many of these cases of existing policies omitted of mention coincide with the policy anniversaries, and sometimes they occur close to the period of fractional payments, three months, six months or nine months.

So I think that is the time for the Home Office to take some sort of action rather than to wait until the rival company makes complaint about it. We make such investigation as we want to know anyway how he fared with the other company and at the same time we always raise the question that I am discussing now. Judging from the results we obtain it seems to me that our inquiry is handled by the medical department of those companies as routine matter, looking at it as a mere matter of insurability, and the reply we receive to our communication is that "the policy was issued as applied for," entirely ignoring our request for the status of the policy and for recommendations to guide us in avoiding even a suspicion of violating life insurance ethics.

I think the practice of a good many companies is along the line suggested by one of the speakers, of refusing to have anything to do with an applicant in which there is room for suspicion of "twisting," and I think it is the intent of all companies to deal with equal fairness with their rivals. I think those are the things that we have overlooked, and we must deal with if we regulate this thing in advance of complaint and improve the respect in which the public holds life insurance.

MR. LINTON: I am very much interested in the subject of the best method of handling the so-called "twister" or "insurance adjuster." The policyholder is likely to be advised to surrender his insurance, take the cash value and invest it. He is then to invest the savings in yearly premiums and interest, after taking out each year enough yearly renewable term insurance to bring the accumulated savings up to the face of the insurance that was surrendered.

This type of case we have successfully met by an analysis of the policy showing the equivalent rate of compound interest that has been produced under such types of policies assuming that the net amount above the accumulated savings is covered each year by yearly renewable term insurance at the rate suggested by the insurance adviser. In practically all cases we have succeeded in holding our insurance where we have been able to find out what was going on. In several instances of this kind we found that the adjuster had charged a flat fee for his services so that we were in the position of actually persuading the policyholder not to take the advice he had paid his good money to obtain.

When one considers the security, the wholesome restraint upon unwise expenditure, the ease involved in the investment of current sums, and the consequent absence of worry, insurance is a wonderful proposition. Most men, when they learn the facts, fully appreciate the great service of the life insurance policy and are loath to surrender it for the adjuster's scheme.

When we face a proposition of this kind I believe it should be met upon a strictly business basis. In other words whether the proposal comes from a policyholder who originates the idea himself or from a policyholder who has been inspired to make the request by an insurance adjuster, I believe we should deal with it entirely on the basis of whether or not the change is advantageous to the policyholder.

There is another heading listed under the subject we are discussing and that is "Adjustment of commissions in cases changed." It seems to me that sooner or later the companies are going to have to face the problem of paying full commissions on policies that are taken out to replace others previously issued. It is a difficult problem. We want to be fair to the agency force and to the body of policyholders as a whole. There are some agents who, in the event of a limitation being imposed by their Home Office, would take the business to other companies. Is it not possible that the time may come when the companies will confer together to attempt to work out some common policy? Life insurance commissions should be paid for actual service rendered and we should remove as much as possible all extraneous incentive for surrendering outstanding insurance and replacing it by new insurance. From the point of view of the insured no hard and fast rule can be laid down, but would it not be well to reduce to a minimum the temptation involved in paying a large first commission upon insurance purchased by the cash value of a surrendered policy?

MR. R. G. HUNTER: I want to say just a word about the lapse rate among policies with loans charged against them. It was the general opinion in our Company that when a policyholder took out the maximum loan under his policy, you might as well say good-bye to the policy. In order to determine the value of this opinion based upon impressions, we investigated the policies upon which loans had been granted in 1915. We divided the policies into those that were charged with the maximum loan and those that were charged with less than the maximum loan. Much to our surprise we found that the lapse rate on policies carrying maximum loans was about the same as on new policies. The lapse rate in the first year after the maximum loan was granted was about 17 per cent; 6 per cent the second year, and thereafter about 3 per cent.

In the case of policies with less than the maximum loan, the lapse rate at the end of the first year from the date of issue of the loan was about one-half of what it was where the maximum loan was granted but thereafter the lapse rate was about the same as where the maximum loan was granted.

It would seem then that a company exposes itself to the same danger of lapse where the maximum loan is granted as it does when it writes a new policy.

We are very strongly opposed to the surrender of a policy with a maximum loan and the issuance of new insurance. We believe that policies charged with a loan should not bedisturbed, that the better thing is to try and induce the policyholders to pay off their indebtedness.

Mr. Lewis Albert Anderson: In connection with the "twister" and "insurance adviser," I wish to say that sometimes we found this so-called insurance adviser on the outside, and sometimes we have found him in our own ranks.

We had an agent who started out on a conversion programme. His argument was that the policyholder could get at least fifty per cent additional protection for the same cash outlay. But the main thing of course was the commission that he could get out of it. We believe that when a policy is sold that it should stay sold, and we do everything within reason to make the policyholder satisfied with his policy.

There was an instance of a man who had carried a policy for eight years. He had a loan against his policy and wanted to make a change, to take out a new policy, and I showed him what the new premiums would amount to and that if he would take the difference between the premium he was then paying on the old policy and what he would have to pay on the new policy, and apply that on his loan, within a few years he would have the loan paid off; he would have the full amount of insurance and at a lower cost than if he took a new policy. The man was satisfied.

Another point is that of applying dividends to the payment of premiums, and I believe that was the means one time of saving my own policy. I was in college at the time, and one year I asked the company to turn over my dividend additions towards paying the premium for that year; and I believe that could be done in a number of cases without reducing the amount of the original insurance.

MR. ARTHUR COBURN: I agree with what Mr. Linton said about the propositions presented by "twisters" and "insurance abstractors."

If the "twister" is giving your policyholder good advice you are under moral obligation to tell your policyholder so. There is also a class of cases where the "twister" is wrong; but the difficulty you have is to get it across to the average policyholder that the "twister" *is* wrong. We have found it successful in such cases to use a comparison of the term extension of the policy that the "twister" is trying to lapse with the term extension on the policy that the "twister" is trying to sell. And another point; the "twister" doesn't usually include his own fee, so if you know what that fee is, include it. Some twisters have a minimum fee of $500, and if that is included, his proposition does not look so good.

MR. JAMES E. FLANIGAN: On this subdivision (*a*) of Conservation of Business: It strikes me that it is not a question so much of just how you want to rewrite a policy, but that you have to rewrite it because some other agent has put your policyholder into that frame of mind.

We have adopted in our company the proposition of not paying the agent the first year's commission when he rewrites one of our old contracts. Of course there are times when an agent has done good work to keep a policyholder for the company, and in those cases we believe he should be paid for the time he puts in on it, and, subject to our own discretion, we pay such proportion of the commission as we think meritorious in such individual cases. In that way you can shut out any agents who make a practice of such business.

On the subject (*b*), "Should any modification be made in the usual rules?": We found before the heavy lapsations started that the rules then in force were very liberal, and I don't see how you could make them much more liberal than they are, and they are more or less the same all over the country.

When it comes to the change of plan I think that your rules could there follow your reinstatement rules, because I think there must be more or less connection between the two; and if anything, the rules for change of plan should be more liberal than they should be on reinstatements. They should go just as far as possible in changing these contracts on their personal health certificates, without requiring actual medical examination. But when a medical examination is deemed necessary, I see no reason why the company should not pay the medical fee, if by doing so it is going to keep the policy on the books.

With reference to (*e*), "Adjustment of commissions in case of change": I think there are just two methods that you can pursue; either charge the commission up to the agent, or to the policyholder, in making the adjustment. Both systems are used with equal success in different companies.

As to the "twister," I was surprised to learn that you think it of so much importance here. Our business is on the lighter premium plans, and I can see now where companies that have business on the heavy premium plans would be subject to a great deal of trouble and annoyance by the insurance twister.

MR. J. C. SEITZ: Mr. Blackburn mentioned about writing letters to the policyholders in connection with their loans. Others also have mentioned the subject, but the reason I refer to the remarks of Mr. Blackburn is because I am just now giving attention to a similar letter, only I was going to phrase it in a manner which I believe suits the purpose psychologically better than any indefinite letter.

In sending the letter that I am preparing now, it is my intention to include carefully prepared figures in each case, to show what the annual payment would be to repay the loan and interest, so that the policyholder would have to exercise no mental effort as to what he should do to pay back the loan in a specified time. That specified time will be ten or twelve years, over which to spread the repayment of the loan in fixed installments covering interest and principal.

It seems to me if this were incorporated in your letter you would be giving him all the necessary information in concrete form. I think it is the psychological way to give the insured something that he will either accept or reject at the time.

In connection with a change of policy form where there exists a policy lien—and this point also covers the problem of twisting—the new policy is usually one issued at attained age on a plan approved by the company. If any offer to the policyholder a new policy with a lower premium and with a provision for loan and surrender value at the end of the first year, then you have something that will offset the offer of a new policy by some other company. Such new policy must necessarily be upon the level premium plan.

I have had experience within the last ten months that demonstrates to me that the conservation of business does not always consist in giving the policyholder the easiest way to continue his policy.

We have been accustomed for a number of years to send to the policyholder, about ten days before the expiration of grace period, an actual concrete premium extension note offer. Our premium extension note account was averaging about forty-four thousand dollars about ten months ago. We began about ten months ago to eliminate this special extension offer of a small cash payment and the signing of a premium extension note, with the result that the premium extension note account fell down in forty-five days from forty-four thousand to twenty-nine thousand and has remained at about that figure since. At the same time the percentage of renewals increased to a marked extent.

MR. G. F. HOLLENBERG: In handling cases of what you might call twisting policies, I think where a man has a twenty-payment life policy of five thousand, and is in favor of the ordinary life policy, you could change that policy to such an amount on the ordinary life as the premium will purchase at the lower rate, and at that rate a man could get additional insurance without additional outlay.

INFORMAL DISCUSSION

REINSTATEMENT OF LAPSED POLICIES

(*a*) The desirability of more liberal reinstatement privileges.

(*b*) The practice of companies as to evidence of insurability required for reinstatement, taking into consideration personal and family history, occupation and habitat.

(*c*) Should the reinstated policy be reissued at an advanced age and dated forward from the original date of issue so as to eliminate, if possible, the period during which the policy was not in force?

MR. JAMES E. FLANIGAN: (*a*) The desirability of more liberal reinstatement privileges. I must confess that I am a little out of touch with what is "liberal" in other companies. But a little over a year ago we decided to do anything within reason to hold what insurance we had on the books and to replace that which had left the books. Anything that was within reason to accomplish that result was done, and now we see no reason for changing back to old methods.

Among our rules is one that we will reinstate any policy in amount up to twenty-five thousand dollars on a staisfactory health certificate within six months after the due date on which it lapsed. Previous to that it was only for ninety days. We do not find that there has been any selection against us. We do reserve the right to require any other evidence we see fit. In cases of policies in excess of twenty-five thousand we grant the three months rule; from three months to six months we require partial examination on which we pay the fee; and in cases over six months we require medical examination and we pay the medical examination fee. We only make the insured pay the medical examination fee in cases where the policy is lapsed for a year.

On the question of extension of premiums: At the time we changed our rules we also adopted a premium extension agreement which we have found to be rather a good one. We grant six months extension on annual premiums, and four months on semi-annual premiums. And, for the extension premiums, we adopted for the sake of simplicity a flat carrying rate of seventy five cents per thousand per month. We figured that would cover actual mortality on those cases.

The last question (*c*) is rather new to me and I had not given that much thought in the past. But I do not see why it would not be a good idea to renew some of the policies that had lapsed for six months or a year at the attained age. I think it is really a hardship for a man who reinstates to pay back premiums when his next premium falls due rather quickly after he is reinstated. That is rather new to me, but I see no reason why that shouldn't be done if it is the means of keeping the policy on the books.

MR. ARTHUR COBURN: Up to about a year ago we required a short form of medical examination for all reinstatements, but owing to the conditions existing then we found that it was not working well, so we adopted a personal health certificate which we used thirty days after the days of grace.

Concerning reinstatements where you have a medical examination of the insured, it is well to consider the purpose of the medical examination. If you could feel certain that in every case there would be no selection exercised against the company, it would not be necessary to have medical examinations at all. For that reason it seems to me that if the lapse is accidental, that is where the insured did not intend to lapse his policy, the company need pay very little attention to the findings on the medical examination. If, however, the lapse was intentional, then I think the company is under no obligation to waive examination. And in cases where a man since lapsing has gone into a hazardous occupation, or if his health has become impaired, or if he has become aware of any impairment in his health, there should be a medical examination. If, however, the change to the hazardous occupation was made prior to the lapse and the insured is as good a risk as he was when the policy lapsed, I don't think there is any selection against the company.

In regard to Section (*c*). The usual rule is that the company requires the payment of arrears of premiums with interest. In some cases where the insurance has lapsed for a considerable period and there has been no insurance in force, that rule does not appear to be equitable. It appears to me that the best plan would be to modify the rule, requiring the insured to pay to the company an amount sufficient to make good your reserve on the reinstated policy, and if you do that I think that is all that you should require of him.

MR. W. A. P. WOOD: There are just two points I want to mention in connection with this subject. First: the Canada Life pays the medical fee for reinstatement after the first lapse, but if any policy again lapses, the Company does not pay the medical fee for the next or subsequent reinstatements.

The second point is this: For about three years now we have used a plan by which policies which have lapsed at least six months and not more than four years could be reinstated by changing the policy date and not charging any arrears for the time the Company was not on the risk. For example, take a policy that was issued three years ago on the Life Twenty-Payment plan, one premium paid at the time of lapse, and that this lapse had taken place two years ago. Under our plan, if the original age of the Assured was 25, we would be willing to reinstate as though it were a policy issued one year ago on the Life Twenty-Payment plan, age at entry 27, and all he would have to pay now would be the slight arrears produced by the difference between the premiums for ages 25 and 27 with interest, together with the new premium for the changed policy. There would be eighteen more premiums to pay after the present one. In this way we give the Assured full credit for all that he has paid on his old policy. I think this method gives the Assured a kindly feeling towards the Company as he realizes that he has not sacrificed anything, even although his policy lapsed two years ago.

MR. THEVENET: In changing policy plans wouldn't there be a question of discrimination arising?

MR. ARTHUR COBURN: It seems to me that the question of discrimination can not arise if you have a uniform rule which you apply to all the policyholders alike. It would be discrimination if you applied a rule only to some preferred class of policies, but where you adopt a reinstatement rule and apply it uniformly to all falling within that rule I don't think the question of discrimination would be raised.

Mr. G. F. Hollenberg: The question in my mind is how would you provide for your commissions to your agents, and how would you provide for your dividends if you simply charged the amount necessary for the reserve?

Mr. Arthur Coburn: The question of commissions to the agents would have to depend on the agency contract. You would have to draw the agency contract to comply with the rule.

In regard to the dividends covering the period the policy has not been in force, our contracts provide for reinstatement on the payment of back premiums, which is the back premium after deduction of dividend with interest, and I am assuming that the reserve on the reinstated policy would be less than that amount, and therefore it would be advantageous to the policyholder to pay it.

Mr. James Fairlie: Mr. Flanigan said that they accepted certificates of good health up to six months after the date of lapse on policies amounting up to twenty-five thousand dollars. I was just wondering whether the company made any distinction between the policies that were in the contestable period and those that were past the contestable period.

A few years ago I read an address made by one of the counsel of the Metropolitan Life in regard to this particular feature, and it was his opinion that statements contained in the application for reinstatement should be examined very carefully as to their falsity or truthfulness before acceptance by the company, because when it was accepted the policy was restored or reinstated in full force, and thereafter the company could not take into account any misstatements made in the reinstatement application.

I think that is an important feature to bear in mind where you have only a mere statement of good health from the insured, or where you require medical examination.

Mr. J. G. Parker: In our company most policies contain the provision that the assured has a contractual right to reinstate his policy within a period of two years from the date of lapse. If he paid two years premiums and then lapsed, one year later he might reinstate by paying one year's premium. If the company had not in some place reserve to reinstate that policy such a reinstatement would be a drain on its surplus. Therefore I assume that we have all put by somewhere in a reserve or contingency fund a surplus to reinstate those policies; so it seems to me quite proper that the company could put in force such a scheme, to reinstate the policy by dating the policy forward one year to the advanced age of the insured. If you put that practice into general effect, giving the privilege to all of your policyholders, there would be no discrimination.

I think you can get your agents to work harder on reinstatements, if you make it worth their while. We have been able to alter our agents' contracts so that six months after date of lapse the agent has no more rights in the renewals of the policy unless he should reinstate that policy himself. On the other hand, if another agent in the territory reinstates the policy six months after it has lapsed, we will pay that agent a reinstatement fee of 15 per cent of one year's premium, and thereafter the renewals belong to the company.

That arrangement has met with no objection from our agency force; in fact they have approved it and it has caused them to work much harder to reinstate policies in which previously they felt they had no interest.

Mr. Thevenet: Along those same lines, in our company if an agent reinstates a lapsed policy he gets the renewals just as if the original writer had continued the policy in force.

Of late we have been reinstating policies by "reinstatement men" in the field, and we have prepared a special form for them to use in order to eliminate the necessity of medical examination. In addition to filling out the blank, the reinstatement man takes the temperature and pulse of the insured, weighs and measures him, and investigates his surroundings. In this way we have been able to reinstate much business that would have been otherwise lost because of inability to get the applicant to the doctor. If the agent wants the renewals he must pay the average expense the reinstatement has incurred. We found this arrangement quite satisfactory.

The greatest difficulty will be found in reinstating a policy that has been lapsed for some time. The objection is raised by the policyholder that he is paying for something he has not received. We could obviate that by adopting Mr. Coburn's suggestion to collect only enough to cover all but the mortality rate. We have never tried that, but there would be no discrimination, it seems to me, if it was uniformly applied to all cases; and then they would not be able to complain about having to pay for something from which they received no benefit.

It would be well worth trying.

With reference to evidence of insurability, we always require a medical certificate thirty days after the expiration of grace, and if we could adopt a six months rule we might reinstate more business. In our state, if a man applies for reinstatement and says he is in good health, and then dies after the reinstatement blank is received by the company, the company has to pay the claim. To controvert it, we must prove that he was NOT in good health when he applied.

I would like to see the rules for reinstatement less strictly applied, because I believe that then we could reinstate almost all our lapsed policyholders. I don't think there is that selection against you that so many of us fear, for many policyholders lapse their policies because they haven't the money to pay when the premium falls due, and the more liberal your rules the more liberal will be the returns in reinstatements.

Mr. Larus: The argument might be advanced that if you make reinstatement too easy, the policyholder will not learn his lesson, and the next year you will probably have to do it over again.

Our company has found that it works well to get a single statement from the Insured, giving his weight, occupation and so forth; that is used for 60 days after the expiration of grace. Between 30 and 60 days after the due date the agent can accept the premium at the same time he accepts the health certificate. Between 60 and 90 days the same health certificate is used but must be approved by the Home Office before the agent can accept any premiums. For cases over 90 days we use blanks covering urinalysis and blood pressure, the insured paying the medical fee.

Mr. Herfurth: I must confess my surprise, Mr. President, that all the discussion relative to this subject has centered itself around involuntary impairments, such for instance as heart affections which would be disclosed by the medical examination whether the short or long form were used. I had expected more reference to methods of checking for possible impairments which might be termed voluntary impairments, such as change of occupation, change of social status, etc.

It is true that every application, in whatever form it happens to be, is intended to cover these points. But I believe that nearly every application for reinstatement is written by the policyholder himself without the assistance of the agent, or any one familiar with insurance underwriting. Therefore, where he has recently or temporarily changed his method of earning a livelihood, he may not consider that it is a change of occupation. Or he may have gradually drifted into a social status which he does not consider a change, but which from our point of view is very material.

To get an applicant for reinstatement to present himself to a doctor for examination, even though we pay the fee, is not always a simple matter. It is, however, easy to get an inspection, checking his occupation, habits and general appearance of good or bad health. Assuming that a man has changed his occupation to one which might lead to physical impairment, we are then put on our guard, and can ask for an examination to discover if any impairment has developed.

Mr. Buttolph: I would like to emphasize, if possible, what one speaker said in regard to the advisability of holding strictly to your rule.

In our company, if a man is one day over we absolutely refuse to accept his premium without an application for reinstatement. We believe it important to impress upon the man at every opportunity the necessity of paying premiums in accordance with the terms of his contract; and any liberalizing of the privileges of the contract we consider, in that particular at least, a great mistake.

It may interest you to learn that the plan suggested by Mr. Coburn has been in operation by our company for some time. If a policy has lapsed for one year or more we will reinstate it. This has particular reference to policies lapsed at the end of the first or second year. We charge the man the reserve necessary to make the reinstatement good, with a small arbitrary loading to cover expenses incidental to the reinstatement.

We have not asked our agents to assist us in this matter of reinstatement, because we do that entirely from the Home Office by correspondence. We have met with some success, but not enough to be wildly enthusiastic about it.

Mr. Judah Philip Bowerman: There has been one point overlooked in this connection which I think is of sufficeint importance to bring to your attention.

Where the applicant, in applying for reinstatement, sends a check for the overdue premium and the company deposits the check, and thereafter declines to reinstate the policy and sends its own check back to the insured, the courts have held that such use of the policyholder's check revived the terminated policy.

There are also cases on record where the company did not use the policyholder's check, but simply held it in suspense during the week or two of the investigation and then, deciding not to reinstate the policy, returned his own check to the insured and still the courts have held, in some cases, that such a retention of the policyholder's check constituted a waiver of the fact that the premium was not paid before the expiration of the grace period.

The only safe way seems to be not to have the policyholder's money in the company's possession until it decides to reinstate the policy.

Mr. A. C. Washburne: We have a plan in operation in the Company with which I am connected which works very satisfactorily both in the conservation of business and in the prevention of lapses. It, therefore, applies to both of these sections. The plan is termed "Extension of Grace Period." If the policyholder, after 31 days of grace, is unable to pay his premium, or if he finds it inconvenient to do so, the agent offers him this plan.

There are two forms. One form is used in cases where the policy has a cash value or equity sufficient to cover term insurance, according to our monthly term rates, for the period of extension desired. In this case, the policyholder simply signs the form which is an agreement to pay the regular premium at a certain future date. If premium is subsequently paid, interest for the total number of months, less one, is charged (one month grace without interest being conceded to all policyholders who take advantage of such privilege). Another form is used in cases where there is no equity,—where the policy may be loaded to the limit with indebtedness. In this case, the policyholder is required to deposit an amount sufficient to cover the term premium for the extension. Then, if premium is subsequently paid, this deposit is given due credit.

In either case, if premium is not paid, and policy is surrendered, the term insurance premium is deducted from the equity of the policy as of date of default and the balance, if any, in cash or its equivalent, is paid to the policyholder.

It will be noticed that the lapse rate of our Company has remained very favorable since this plan was adopted. It is a pet of my own; there is no patent on it. If anyone desires further information concerning the plan, I shall be pleased to send him a copy of each form.

MR. ROBERT M. WEBB: The idea expressed by one of the speakers here of reinstating the policy by exacting merely the amount of the reserve for the period during which the the policy was lapsed does seem to me to be a little inequitable to the persistent policyholder. The persistent policyholder has, during that period, paid all of the premiums due under the contract. When you reinstate a lapsed policyholder you put him back on exactly the same basis as the persistent policyholder with the same policy and age and amount; enjoying the same benefits.

It seems to me that in order to do that the policyholder should make up the contribution not only for the reserve, but for the expense fund as well. Out of the premiums of the persistent policyholder the company makes a contribution to the reserve fund, a contribution to the mortality fund and a contribution to the expense fund. And yet, while this policyholder whom you reinstate has made only the reserve contribution, he is in the same position as though he had never lapsed.

That seems to me to be a discrimination against the persistent policyholder, and therefore I believe it entirely fair to charge a man the gross premium on reinstatement.

Mr. G. F. Hollenberg: Sometimes in the participating companies the difference in the dividend will be a less amount for the period than the difference in the reserve. I think the policyholder should be made to pay the whole back premiums to put him on the same basis with the persistent policyholder. Why penalize the persistent policyholder for the benefit of the lapser?

INFORMAL DISCUSSION

AGENCY PROBLEMS

(*a*) Is it desirable that the education of the Agency force be handled by the Home Office or by the use of outside institutions?

(*b*) Commissions payable under an Agency contract. The proper grading according to plan.

The limitation of commission at advanced ages.

The limitation of commission on large risks which are reinsured.

(*c*) The payment of commission where premium is paid by policy loan or Automatic Non-forfeiture loan.

(*d*) The assistance an Actuarial Department can render to the field force.

MR. J. A. CAMPBELL: I just want to say a few words about the last three sections of this subject.

It would appear to me that there should be no great difference between the amount of commission payable under one plan and the amount payable under another plan. My reason for that is that the agent should not be induced, because of greater commission, to possibly write his business on a plan which would not be suitable to the policyholder. This question is also bound up with the second section (*b*).

Some time ago the company with which I am connected introduced a series of income policies maturing at ages running from fifty to seventy, and we decided on certain commissions to be used for all these plans. On investigating it we found that satisfactory results could be obtained by paying the agent a percentage of the premiums and a percentage of the sum insured.

We also investigated the use of that same method for all plans, and found that 25 per cent of the premium and 1 per cent of the sum insured would be almost equal to 60 per cent on the whole life, and 40 per cent on the twenty-year endowment, and 20 per cent on the twenty-payment life. This method gives possibly a higher commission on the younger ages, but makes an automatic allowance for increased premiums on the older ages.

As to the limitation of commission on large risks which are reinsured, it would seem that this would not be advisable if it is possible to avoid it. The agent writing a large policy would feel he had been discriminated against if he was required to give up part of the commission; on the other hand, in the case of a small company it might not be possible to pay the whole commission on the same scale they were paying on the smaller policies.

In this connection, if the reinsurance is on the co-insurance plan, and the company is able to obtain the same commissions from the reinsuring company, there would seem to be no objection to it.

Considering the payment of commissions where the premium is paid by policy loan or automatic non-forfeiture loan, if the renewal commission is to be considered as a collection fee, it would appear to me that the commission should only be paid in cases where the premium is actually collected by the agent; and if the premium is charged to policy loan or to the automatic non-forfeiture loan, I think no commission should be paid.

J. S. Hale: I just want to say a few words on the first topic under Agency Problems. "Is it desirable that the education of the Agency force be handled by the Home Office or by the use of outside institutions?" In my opinion there is really only one side to the question as far as the average agent is concerned; it can best be done by the Home Office. I think his education should be largely along the lines of the aims of the Company by drilling him in its particular policies and what they will do.

We have found that several of our men who have gone to outside institutions have not been benefited to any extent, if production be the criterion. They learn a good deal of theory, but in putting the theory in practice, they perhaps don't spend enough time in selling insurance but spend it in showing what they know. The value of any agency force is in its loyalty and morale; it can be developed only through proper agency leaders directed either through the Home Office or in the individual agencies.

We feel that the Home Office education is preferable to any education that can be received from outside sources.

Mr. J. G. Parker: Mr. President, there is one way in which an Actuarial Department can render assistance to a field force. You are familiar with the service given to the field force through the agency supervisor, and by preparing agency reports in following the work of the individual agent. I won't add anything to that, but there is one thing that we, as actuaries, can do and that is the training of salesmen right from the Actuarial Department. I know of men who have been trained in Actuarial Departments, who have passed one or two examinations in the Institute and later have been developed by the Actuarial Department into salesmen who have gone out in the field and made themselves the strongest field men imaginable. They should, of course, have the characteristics of salesmen to begin with. They should be strong enough not to be affected by the theory of which Mr. Hale speaks, that is, that they won't go out and try to teach the insuring public what they know about actuarial terms. But we can render a real service to the field men by our training, fitting them for agency salesmen.

I know it has been very successful for that has been the purpose right from the beginning.

Mr. W. A. P. Wood: Mr. President, we have had some experience, both with outside institutions and our own classes. We think that our own classes are much preferable.

In connection with our work there are two different sections. Over a period of years we have prepared what is really a correspondence course, little booklets to be read followed by certain examinations. This is chiefly for beginners. Of course correspondence courses in themselves are not the best means to the end, but every agent can be reached by starting in this way. Then, after he has been in the work for some time we have classes that he can attend, usually conducted at the head office.

One of our reasons for having these classes is to bring the men from the field in personal contact with officers and others in the head office, to give them some conception of our ideals and to have the personal touch. We believe that this personal touch has been valuable to them. We are told that getting to know the men in the head office in this way, through the use of these classes, has increased the loyalty of the agents to the company.

At these classes, wherever they meet, several of our officers discuss various topics, not only in agency work but also other lines of insurance.

The class broadens the ideas of the field men, I think, and the influence is apparently good by bringing these men to the head office of the company for the week's course.

MR. LINTON: Our experience in sending agents to schools of life insurance salesmanship has been such that we are not yet prepared to recommend or discourage this method of training. About twenty young men and women connected with our Company have attended these schools but statistically the results do not lead to any definite conclusion. A few have left the life insurance business altogether. Others have been struggling along without making any marked success. Some others have made fair records and few, rather good records. To what extent the results have been influenced by the original selection of the students or what the results would have been if they had not attended the schools, none can say.

The more we study the question we find the outstanding problem to be the obtaining of the right type of general agent. You can bring a sub-agent to the Home Office and give him a thorough training or you can send him to the best possible school of salesmanship but if he goes into the field without the support of a well-informed, teaching type of general agent who can enter into his problems, guide and help him, the whole thing is likely to fail. To get the right type of general agent is, I believe, a pressing problem for all Insurance Companies.

MR. LARUS: Some years ago we faced an agency problem that involved the correction of our system of training. At that time we inaugurated a required training course of six weeks at the Home Office. We would allow, as a substitute for that, one of our contracts to be given a man who attended an agency training school in a recognized institution.

We have had about 90 per cent of our agents at the Home Office, and have thus had a very limited experience with the graduates of the training schools. We feel inasmuch as we are running the Home Office school ourselves it is much preferable to have the agent at the Home Office.

A company lacking that training school would of course have the question of expense come up in a consideration of it. It would be much more expensive to start a small school than to use one of the institutions. But we have the equipment for a school and we propose to have it at the Home Office, because there the agent can come in contact with his company and its officers, learn its methods and ideals, and thus he is bound much more closely to the company; and we feel that it reduces the turnover rate more than if he simply would attend an institution. We hope to cut the turnover rate considerably by our method. We have cut down our bad turnover rate of the past few years quite considerably, but the problem is still of importance and the travel expenses are liable to be fairly heavy in getting some of our agents from the western part of the country to the Home Office.

We require that the agent stands his own travel expenses and living while at the Home Office and during his course of training we pay him a guaranteed salary which we consider more as a minimum living expense. We more or less require that he dip into his savings to take this course, feeling that if he makes a sacrifice it is an evidence of greater interest and more closely ties him to his opportunity as an agent.

It has come about that we felt the six weeks training school was possibly a little too long, and we have cut it to one month. We also found it was better not to force the agent to come immediately to the Home Office for his training before obtaining any field experience, for two reasons: In the first place, when he came to the Home Office there was so much of the theoretical side for him to assimilate in the short time that he was with us, unless he had previous field experience, that it was very difficult for him to hold all the information, and he was very liable to become theoretical and mold his selling talk around rates more than around service and protection. We also found we were misjudging some men in accepting them whereas if they had had a month or two in the field under the general manager, it would have appeared that the men should have gone no farther.

In other words, the selections that we were able to obtain by the methods we used, such as an intelligence test and personal history applications and so forth, were not sufficient to enable us to determine as accurately as we would wish whether the man would be a success in life insurance. We could determine that much more accurately after a month's experience under the supervision of the manager.

The Home Office course is run by a sales training organization the head of which is a special instructor—although I suppose over half of the lectures that the men get are given by the Home Office Officials, each one with relation to his own department.

In that way it gives us a splendid contact with the new agent and I think binds him more closely to the Home Office. It is expensive, and sometimes it is a sacrifice for the agent who expends so much effort before he can get any financial return for himself.

Mr. L. A. Anderson: Mr. President, on the whole I favor the Home Office instruction. We have had a few men who have gone to outside training schools and come back with a great deal of enthusiasm. I think they are better men for it, but I think there is a danger there too, in that they are more apt to leave you after they have been educated on the outside than if they were trained from the Home Office.

We have pursued a somewhat different policy; that is, getting the agents together in comparatively small groups, and two or three or sometimes even four of the men from the Home Office talk to them on various subjects. We let the agent understand that he may bring up any questions with which he is troubled. We sometimes have a question box so as to get at the specific problems with which the agents have to contend.

So far it is really the best method that we have been able to hit upon.

In my opinion it is a difficult matter to lay down a universal rule to follow. In the first place you should study the character of the men in the Home Office. If you are fortunate enough to have a number of experienced agency men at the Home Office, you are better able to teach the agents.

I have in mind also smaller companies organized by men who have had little or no experience in agency work. In such cases it is desirable to bring in men who have had such experience. A company of that kind would probably profit more by having their men go to some outside school, but on the whole, I favor the Home Office, and convention instructions.

Mr. W. H. Cox: We have had several new agents take courses in these training schools, the outside institutions, and on the whole the result has been unsatisfactory production. Whether it was because of the training or because these men were doomed to fail anyway, I can not say.

As a general thing I believe that the training should be developed among the agents with the general agent or manager to look after the training to a great extent himself, with assistance from the Home Office.

We get out periodically what is known as The Service Bureau Bulletin, giving them information on selling problems, describing new policies, and so on. We have a team that will go out and spend a couple of days in a given district or a general agency trying in every way to bring the information that the field must have up to date, underwriting and so on. It will spend the morning during this meeting in which the different officers are open to questions and the members of the agency force have individual talks.

In regard to Section (*d*) I believe it is unfortunately true but it is true nevertheless that there is not a sympathetic relation between the Actuary and the field force, as a rule. Now, the greatest assistance that you can render the agent is a sympathetic attitude toward his problems. You can dress up your policies in a way that will be attractive for the public.

I was greatly amazed yesterday to hear the discussion about taking the commission away from the agent and changing his contract and so on. The Actuary can be of greater assistance to his company and to the insuring public and the agency force if he will lend a sympathetic ear to the agents who are out fighting the battles of the company and who are in closer contact with these insurance problems.

MR. A. G. BIGGER: I have been out of the agency game for several years, nearly four years; but I had eleven years of continuous service with one company as agency superintendent, and there are just a few things that I want to call to the attention of you Actuaries, especially in regard to agency matters and the relationship that should exist between the agency superintendent and an Actuary or a company official.

As I trot all over this country—I am just back from a trip to California now—and I go into the Home Offices of life insurance companies I see many tragedies. I could not go from one company to the other and tell what they are; but it makes my heart sick to see the waste that I do see in the management of life insurance companies in this country. And I don't say that egotistically; it is a fact. And an appalling factor in the money being thrown away over this country is in inefficient agency work. It doesn't all lie at the door of the agency department.

Get a good man, an agency man, about the first thing you do is to put a great, big question mark in your mind as to whether he himself is honest and 4-square, and whether he is sold out entirely to the agency or not. One of the greatest offenses you can make is to let your agency man feel that the staff is not supporting him and has no confidence in him, in his integrity, in his honesty and his ability to handle an agency force and to be absolutely fair as between the company that he is supposed to enthuse and through whom he is to get business.

I go over the country as I have said, and found many of our companies without an agency head at all, or it was just an empty title hanging on a nail with a half dozen others. The Actuary sometimes even is the agency manager; in some companies I saw them actually going out with a rate book and attempting to write an application. I was associated with one for about eleven years; if I recall he wrote one application in that time—and never did get his man examined.

Seriously, I am in earnest about this proposition as to the waste of money going on over the country. I have met it everywhere. The best thing you can do is to lop off a little of the salary of the president or vice-president who holds his office by virtue of having some money in your institution, such a man who never carried a rate book in his life or wrote an application; and put some high grade man in your agency department in whom you have confidence and trust, and tell him to get out and get business within reasonable limits, such a man as will have the personality that will hold men, who will bind men to him as if by hoops of steel; and let him get your agency force, train his young men, and he will make big men out of them.

I am not saying a word against general education for life insurance. I have accepted a position in Judge Cockrell's school as a teacher beginning in January for a general course in salesmanship. But every agency manager is training his men today, his men and the company's men, to go in the field with their minds made up that they are connected with one of the best businesses in the world, one that will give the policyholder a fair and square deal all along the line, and he should make no guaranties unless he feels that way. The agency manager must be a man who holds the balance absolutely fairly and squarely between his company and the men in the field, to make the field men know that he won't put anything over on his company that is not for the good of his company, and that the field men can not know is for anything but the good of the company. In that way he will make of his field force a loyal unit that can not be disrupted in any way. But you Actuaries and company officials must have a little more confidence, and back up such a man a little more strenuously with your company officials. If you haven't got the kind of a man that you can back up and turn loose within prescribed limits of safety, then you have got to go out and get one; but when you get such a man, then stand back of him.

MR. MEAD: We have three actuaries out in the field and they are having good success, so our experience is better than Mr. Bigger's.

MR. PHELPS: There is one advantage in having the education of agents handled by the Home Office rather than an outside institution that I don't believe has been touched upon: that is, that your same organization can be used in educating your Home Office clerks.

Our company has a correspondence course for agents. In looking over the course I notice that, with the exception of a few lessons devoted to the problems of salesmanship, the balance of the course, I thought, was of more value for Home Office clerks than for the agents. I urged all the employees in the Actuarial Department to take up this course, and while quite a few have fallen by the wayside it has been of considerable value to those of them who have completed it.

MR. ANDERSON: Mr. President, I agree heartily with what Mr. Bigger has said, but I too have traveled more or less. I was with the Wisconsin Insurance Department about thirteen years and I saw the problem from a slightly different angle. It was my business not merely to check the liabilities to see that the companies were solvent, but also to see whether or not they were economically managed. I agree that the Actuarial Department should do everything within reason to help the Agency Department and it has been my ambition to do that, but while I was with the Insurance Department I ran into cases where some agents had the idea that they must have anything and everything that every other company has and a few more for good measure. The net result was in some cases that policies had been gotten out (rates computed and policies printed, etc.), and not enough of them sold to pay for the printer's ink on the policies. Not all Agency Departments, however, are imbued with that idea.

I am reminded of a man I knew some years ago who organized a fraternal society that was mathematically unsound, yet he and his associates were able to accumulate a considerable sum in a few years. You couldn't talk to that fellow more than five minutes until you would hear him say, "We don't," "We don't do this," "We don't do that," "We have a policy that we believe is right and we are selling it and that is all we are selling." He laid stress on the virtues of the policy and he built up a society of some 30,000 members in only a few years. He literally tied to himself some of the best business men and professional men in the state and in adjoining states, lawyers, doctors and business men simply went with him to the limit on that one slogan, "We don't." He would say that "We don't believe in spending the policyholders' money in that way, etc."

Of course I don't think we should lay too much stress on that but just a little of that conservatism is very good. When we have a list of policies that will sell, when they really fill a need and render service, we should lay stress on the virtues of the policies we have.

I remember also when I started out in agency work some twenty-seven years ago, I met a man who wanted insurance. I thought he needed insurance and I showed him one policy after another and he didn't want that and he didn't want that, and when I had showed him all I had in the rate book, he said if you will give me a policy that will provide so and so I will buy. In my enthusiasm I wrote to the Home Office to get out such a policy. The manager came out shortly after and he said, "Say, Anderson, don't fool away your time with people who won't talk business. If there is anything in the life insurance market that is worth while we have it in our rate book."

That was one of the best pieces of advice I ever got, because the policies that were in the rate book were those that were practically standardized by usage, they had been tested and tried, and by selling those I made more money for myself and I believe I rendered greater service to my clients.

I believe in sticking to the good old standards and having the agents understand that getting out new policies to meet and to beat everybody else is expensive business.

THE PRESIDENT: One subdivision of this subject that no one seems to have touched on yet, the payment of commission where premium is paid by policy loan or Automatic Nonforfeiture loan. Is any one prepared to give his own experience or an opinion on that point?

MR. HOLLENBERG: Mr. Chairman, I believe that is a question that is controlled by the agency contract. If your agency contract provides the agent is to receive a commission on every premium paid in your office you are not justified in witholding it from him because it is taken care of through that automatic feature.

That has been the attitude of the Union Central.

MR. F. S. WITHINGTON: Mr. Chairman, I would like to hear some expression on the subject included in the last sentence of Section (*b*): The limitation of commission on large risks which are reinsured. I know there is a wide difference of opinion regarding the proper treatment and methods in this respect.

I might say that during the time I was connected as secretary and actuary with a company in the west, the Western States Life, I made this rule, which was embodied in the agency contracts of the company: That commissions should only be paid upon the premium which the insured paid (the full premium for the whole amount of the policy issued) less the net cost to the company of the reinsurance. We had no trouble with this; one reason perhaps was because that was the way we did it from the beginning.

It seems to me that that is a just method of handling the matter, fair to the agent as well as to the company. I would like to hear some expression of opinion and description of the methods of other companies in this respect.

MR. SHEPHERD: I would be glad to state our views with regard to the questions that have been asked. As to the question of limitation of commission on business that has to be reinsured, I think that is dependent on the amount the company will handle. If that is small compared with the amount they are willing to retain, the necessity for modifying the commission is not so great. Our gross amount is not limited; we write some very large policies in comparison with the amount we retain. We accept an amount of insurance equal to twice our retention without any modification whatever; in cases in excess of twice our retention we do modify our commission.

Perhaps I can explain our method best by saying that the premium on the excess amount is divided into two parts, an amount equal to the amount we pay for reinsurance, and the balance. On the first amount we allow only such commission as we get on reinsurance; and on the rest of the premium we pay the regular rate. We find only one objectionable feature in that, and that is that the agent writing a large case or accepting one from a broker does not know beforehand what the amount of his commission is going to be, so we have changed that method, but have carried out the same principle under a more specific formula.

As to the payment of commissions on premiums paid by policy loans or automatic non-forfeiture loans, if the premium is paid by policy loan we pay commissions on it just as if in cash; if it is paid by automatic non-forfeiture loan we don't pay any commission. If that automatic premium loan is later paid off the commission is allowed, or if put in the form of a policy loan the commission is allowed.

We feel that if the policyholder will commit some positive act such as execution of a loan agreement, we are in a better position than if he allows his policy to slide under the automatic feature.

MR. BOWERMAN: Our plan for dealing with commissions to agents on policies reinsured has been in operation for five or six years, and we have no complaints coming from the agents.

The plan is this: Suppose we write a policy for $50,000 and reinsure $40,000. The agent gets his full commission on the $10,000 we retain, and the way we ascertain the commission we are going to pay him on the other $40,000 is by applying the following rules:

Credit: Agent first-year contract commission on our premium on the part fully reinsured.

Debit: Agent the actuarial loading on reinsurance company's premium on the part fully reinsured.

Credit: Agent first-year commission we receive from the reinsurance company.

Exceptions:

(1) Agent's first-year commission never to exceed contract commission.

(2) Agent's first-year commission never to be less than the commission we receive from the reinsurance company except when the reinsurance company's commission is greater than ours.

(3) If the aggregate loss to the company by following the preceding rules is less than one dollar, ignore it entirely.

MR. E. A. PORTER: In this connection it would seem that the motive for doing any such reinsured business should be given a good deal of weight.

This does not seem to be done for profit. For reinsurance there is paid out (under the popular A. R. T. plan) the full American Experience expected mortality. There is not, evidently, any mortality saving to be realized. Now, the gain and loss exhibit of almost any company operating in the United States will reveal that salvages from the expected American Experience mortality play a very important part in its financial progress. Some very great readjustments would be required if such salvages were not had. Even allowing for considerably lower unit costs in the issue of relatively large policies, there is not, in my estimation, any substantial margin of profit in the reinsured portion of such a policy. From a purely financial angle, this excess business is done at considerable inconvenience, with meager margin of profit, if indeed there be any, and with always the possibility of the original company, through some clerical error, finding itself upon a risk for a larger amount than it ever desired to assume.

The idea of it all seems to arise in a spirit of service to the policyholder and to the agency staff. To the policyholder, that he may carry the insurance he needs, within liberal limits, with the company which has his confidence, and to the agent, that he may not feel that he is at a disadvantage because of his connection with a young company, which limits its own risk to a conservative figure, rather than with some older and larger organization, which is able to safely risk a larger amount.

Now, if this is true, it does not seem proper to tie too many strings to the service which is being given. When something is done for the purpose of upholding morale, I do not believe it should be hedged around with petty restrictions. I do not, then, advocate reducing the rate of commission as soon as the case passes the company's limit. Full commission should be payable on such an amount as will insure satisfaction among the agency staff, yet not on such an amount as will prove a burden to the company, or a great incentive for the presentation of very large cases.

The limit to be placed appears, then, to be largely an agency question, and to be determined from consideration of the composition of the field force and the volume of large policies produced by it, yet with the safeguarding of the company's interest always kept in mind.

Mr. M. W. Torrey: I agree entirely with the last speaker. I feel that the company should not write a gross risk for a larger amount than it can afford to pay the agent full commissions.

Mr. R. B. Coit: There is a distinct difference between a policy continued in force by a policy loan and one under the automatic premium loan provision. In the first place, the insured borrows and pays the premium; in the second case, the policy is continued in force under an automatic nonforfeiture provision.

Our company's policies carry the automatic premium loan provision, but we do not pay a commission when the policy is continued in force under that provision.

Mr. Bagley: Some years ago The Travelers limited commissions on policies reinsured. The reinsurance was usually on the form of the reinsuring company and therefore the agent was allowed the same amount of commission as was allowed under the reinsurance. As a matter of routine it did not work very well, as mistakes occurred frequently. On some large case upon which there was reinsurance the agent by some oversight would get his full commissions on the total amount of insurance, but the next time the routine work would be done properly, and he wouldn't get it. Naturally there was dissatisfaction.

Finally the Company decided that it would stand the cost of the reinsurance rather than ask the agent to bear any of the burden. The Company felt that in giving this facility to the field it should not penalize the agent for using the facility.

Perhaps we do not carry this principle as far as we should. In contests the agent does not receive credit for the amount of business written in excess of the amount retained by the Company. For instance, if we have $100,000 on a risk and another agent writes a new policy of $100,000, it all has to be reinsured, so that it does not enter into his contest total at all. Again, we have some agency contracts under which the renewal commission for the next year depends upon the amount of new business paid for in the preceding contract year. That is based upon premiums rather than amounts.

We have never seriously taken this point up for consideration because there has never been any objection. Personally, I feel that it is not carrying the fundamental theory to its fullest extent. I see no reason why an agent writing a new policy which has to be reinsured entirely should not receive credit for his work, whether the policy is $5,000, $50,000 or $100,000. He has spent the effort honestly, and it seems unfair that he should not get full credit for it.

MR. THEVENET: I want to disagree on the subject of the renewal commission on automatic loans.

Of course it is just a question of whether renewal commission is additional compensation, which is the way the agents usually look at it (I did, when an agent,), or whether it is for services rendered for keeping the business on the books, which is the way the companies look at it.

Automatic loans are put in the policy to facilitate the payment of a premium in case the insured does not pay on time; and it goes into the books as a loan and very often is repaid either in cash by the insured or taken out of a loan made in the usual way.

The only just way to treat the agent, if you are not going to allow him commissions on the automatic loan, would be to allow it when the man paid it back or when he makes another loan and it is taken up. Of course that would complicate your bookkeeping; the agent may be out of your service when that time comes, but in justice to him you would have to allow it and pay it to him.

The agent's first year commission is usually taken up largely in expense in procuring the business, and his main source of profit, or at least a very material part of his profit, is represented by his renewals and if the renewal commission is not considered a collection fee, I don't believe it makes any difference how a premium is paid, automatically or otherwise, the agent should receive the commission on it.

Now, as far as the desirability of education in the Home Office or some institution is concerned, the most comforting thing I see is that the idea has penetrated the consciousness of the Agency Department that an agent ought to be educated, and that it is not sufficient to take a man, give him a rate book, your blessing and perhaps $100 and tell him to go out and get business. In my time the idea of education seemed never to enter into the calculation at all. Personally, if I wanted to train a man I would much rather he had received some education in some college or somewhere before I got hold of him. If he knows something about the insurance business before I get hold of him to train him to do my work, it will make my work much easier because he will at least have had some information that will make it easier for me to tell him how I want my business done. I don't believe a man can come out of an institution and be a cracker jack agent any more than anybody is capable of doing highly technical work when he comes out of college. When I was in the engineering business, if a man came to us to get a job and he had a diploma from an engineering school, about the best thing he got was driving stakes until he learned how to put in practice the theories he learned in school. I think that is pretty much the same thing with an agent. If we had courses in the schools designed to teach insurance salesmanship, without doubt a proportion of the men graduating therefrom would be mediocre salesmen, some, quite a number, perhaps, would be failures as is the case in other professions, but I believe that if we would require that a man learn something about the insurance business before he comes to us, our labor in educating him in our way of doing business would be much easier, and we would have fewer failures.

As to the question of our commissions on reinsured business, I think Mr. Porter is right that it is more or less of an agency problem. If a man writes a $50,000 policy he expects to get commissions on $50,000; but he doesn't always get it from newer and smaller companies. We do not pay commissions on amounts in excess of $25,000; but I believe like Mr. Porter, if we get men who make a business of writing $50,000 policies, in order to keep those men we will have to pay commissions; otherwise they will work for somebody who will pay them.

Mr. Wilbur Johnson: I believe that many companies will be willing to pay the full commissions on policies, if they can afford it. And I believe that by making arrangements with other companies they can afford it.

If company "A," whose retention is $10,000, would seek out company "B" which has a similar retention, and would pass on to that company the excess with the understanding that company "B" will in turn pass over its excess, then comapny "A," while losing the mortality savings on the proportion it has sent to "B" on a particular case, will gain the mortality savings company "B" will send back to it; so it will be in a better position to pay the full commissions if it gets as much as it gives.

MR. McBRIDE: There is one aspect of this sub-topic (*b*) omitted I dare say because of its obviousness; yet the fact that it is obvious may result in more dissatisfaction on the part of those agents who are deprived by some of the practices described of part of their commission.

Take a case, for instance, of a company whose net retention is $10,000, and a policy is issued for $50,000. In our own case we would require two examinations, so that our medical fees would be $10 for that $50,000, and approximately $400 or $300 would be spent in obtaining reinsurance on the $40,000 Excess. The same agent writes fifty $1,000 policies on which we pay $5 for examination. We pay $250 for the examination of $50,000 of insurance in $1,000 denominations as compared with the $10 that we paid where the same volume is represented by one policy. There is $240 difference in favor of the $50,000 on one life, which to my way of thinking goes a long way towards justifying our practice of allowing the agent commissions on all of the insurance that he sells.

MR. WITHINGTON: Mr. Chairman, may I say another word regarding that matter of commissions on reinsurance?

One of my objects when making that rule was to prevent the agent of a small company from changing rate books. Very few agents capable of placing $50,000 risks are going to work for a small company. We limited the gross amount which the company would take on any one life to $35,000, the net retention being $10,000, which was quite a good-sized amount for a small company. That was the main object in making that rule.

Now, I don't want to speak too much about the cost of reinsurance; that is too complicated a subject to discuss now. And it isn't on the program. But since that has been referred to, I would like to say a word.

I have always believed that reinsurance costs something, that is to say there is a loss of profit to the company which is obliged to reinsure the excess risk. And it seems to me that if the reinsuring company makes a profit on its reinsurance, the company which places that reinsurance is certainly losing some profit.

Now, reinsurance on excess risks will always be more or less necessary. I think, however, that the gross amount, the limitation of the gross amount issued by a small company should be more limited than it is. Although of course we must be more or less generous with our agency force in these respects.

MR. S. E. ALLISON: Some of the speakers have said they believed in giving commissions to some agents on the excess and not to others. Personally I believe if you are giving the commission on the excess to one you should to all.

We give it in our company to all agents up to $100,000.

INFORMAL DISCUSSION

DISABILITY AND DOUBLE INDEMNITY BENEFITS

(*a*) The practice of companies with respect to adding Disability and Double Indemnity benefits to existing policies.

(*b*) What is the proper limit of monthly life income per $1,000 of insurance for the permanent and total disability benefit?

(*c*) Advisability of limiting the amount of disability benefits granted at the younger ages at entry.

(*d*) The insertion of a clause providing for increased benefits five or six years after the claim has been incurred.

(*e*) The insertion of a clause providing for the charging of premiums as a loan should disability occur after the age of 60.

(*f*) Is Hunter's table a sound basis for disability premiums when the disability clause states that three months' total disability shall be accepted as evidence of permanent disability?

Mr. R. G. Hunter: I don't know generally the practices of other companies in regard to including disability and double indemnity benefits on existing policies, so I will just outline the practice of my own company. We add the disability benefit freely to all old policies, and have done so from the very beginning. We require evidence of insurability on short medical form, the fee for which is paid by the insured himself. The premium is charged from the time the benefit is added and based upon the attained age of the insured, and the number of years' premium remaining to be paid under the insurance contract. It should be remembered that the premium waived is the premium at age of issue.

In the case of a man applying for the benefit between anniversaries of the policy we take the age at the next anniversary and charge him a proportionate premium up to that date.

In the case of the double indemnity benefit, we did not have quite the same feeling of security in adding such benefit to old policies. I believe that was largely the feeling of the lay officers of the company, rather than of its actuaries and medical directors. In the beginning we didn't add double indemnity benefits to any policies; later on we overcame the feeling of insecurity on the part of the lay officers and we are now adding double indemnity benefits to all old policies. We do make this one exception that is not applicable to the disability benefits, viz., that the man must have been in his present occupation for two years and expects to continue in that occupation, and we must be reasonably sure that he will continue.

I can not tell whether there has been any particular selection against the company in attaching either the double disability or disability benefits to old policies, because we haven't had a sufficiently large amount of business to warrant any investigation. I forgot to state that for the addition of the double indemnity benefit, we require a physician's certificate; in some cases it is not necessary, a personal certificate probably being just as good; but we don't want to make it too easy for a man to attach the double indemnity to his policy, the reason being that we are not quite as enthusiastic about the double indemnity benefit as about the disability benefit.

(*b*) What is the proper limit of monthly life income per $1,000 of insurance for the permanent and total disability benefit? I don't know; but I hope it is going to be $10 per thousand.

I have never thought very much about the proper limit; I have just felt, as I presume most of the rest of you have, that when we come to $10 a thousand we have gone far enough, and we should stop right there. There is a relation, however, between the income to the beneficiary and the income to the insured. The insured, for instance, has decided he wants to leave to his beneficiaries and to his family $100 a month. There should be some relationship between the $100 and what he is going to receive if he becomes totally and permanently disabled; and the difference should be, I suppose, something approximating his living expenses. Let us assume he could get along on 75 per cent more than that $100 a month; then you would have $175 a month as the amount to be paid in disability annuity. It takes about $17,500 of insurance to provide an income of $100 a month to the beneficiary for twenty years certain, and such amount would provide $175 a month to the insured in case of disability. This works out at exactly $10 a month per thousand which is the proper limit of the disability benefit.

(*c*) The advisability of limiting the amount of disability benefits granted at the younger ages at entry. I don't know just exactly what was meant by that question, as to what the younger ages of entry are, so I will simply state the practice of our company.

We don't grant disability benefits below age 15, After 15 we limit them to the amount of insurance that we grant at the younger ages. At ages 18 to 20 we grant $10,000; so you see that would limit the amount of disability benefit at those ages. At 21 to 24 we grant $30,000; but the maximum amount that we will issue with the disability benefit is $25,000.

I really can't see any particular object in limiting the disability benefit at the younger ages, except as the amount of the insurance is limited. At least that is the view we take.

(*d*) The insertion of a clause providing for increased benefits five or six years after the claim has been incurred. I haven't given this subject enough thought; I will leave it for somebody else to discuss.

(*e*) The insertion of a clause providing for the charging of premiums as a loan should disability occur after the age of 60. Since the inauguration of the disability benefit, I have been associated with two companies that adopted the benefit. The first company put in a clause providing for the charging of premiums as a loan. The actuaries didn't want it; the agency department, however, believed it to be of some selling benefit. The second company didn't have such a clause. We felt it was insignificant, wasn't worth while, and caused us a whole lot of trouble. I can say in the four years I have been with the last company that I have not run across a single case of competition with a company that does have the clause, and we have never had a request from any of our agents to put that clause in our policy.

(*f*) Is Hunter's table a sound basis for disability premiums when the disability clause states that three months' total disability shall be accepted as evidence of permanent disability? We haven't placed that clause in our policy, so I will leave that question for those who are better qualified than am I to answer it, except to say that I fail to see how it could be a sound basis, since it is self evident that Hunter's table was not intended for that sort of disability.

MR. LARUS: This whole subject of disability and double indemnity must be viewed in the light of service to the policyholder and agent. I do not believe a company can insert these benefits primarily for its own profit. If it can break even on them, the service it renders the policyholder and the agent should be its justification.

Relative to the first question, (*a*) The practice of companies with respect to adding disability and double indemnity benefits to existing policies, I believe that by allowing these benefits to be included in old policies we are doing a service; if we refused this privilege there are experimentalists who would be surrendering their old policies and getting new ones. Mr. Hunter's practice is probably followed by most companies. We make for the future an extra charge for the disability or double indemnity benefits based on the plan and attained age. We differ somewhat with Mr. Hunter on the evidence of insurability required. The company with which I am connected has asked for a full medical examination as a requisite for the insertion of either of these benefits. We have done this, after talking the matter over with our field force, mainly because we felt it would give them a loophole for new insurance. We charge the policyholder the fee for the medical examination unless the agent is successful in placing new insurance at the time.

(*c*) The advisability of limiting the amount of disability benefits granted at the younger ages at entry. That brings up the question of undetermined occupation. If the occupation is not determined, your insured may go into a very unhealthy occupation. I think the company should be conservative, and reduce to a small amount the disability benefits they will grant prior to the settling in a definite occupation.

(*e*) The insertion of a clause providing for the charging of premiums as a loan should disability occur after the age of 60. As a service to the policyholder I think this benefit is more or less negligible.

It is hard enough, in many cases, to determine the actual fact of disability. The feeling in most companies is that the older the policyholder the more difficult is such determination. It would be extremely difficult, in cases of policyholders over 60, to determine whether disability exists.

I believe that the insertion of such a clause would result in one of two things: either an innumerable number of disputes, or a free granting of the benefit to almost any one who applies for it. In this latter case the benefits will not be covered by the premiums calculated.

(*f*) Mr. Hunter's table, I believe it may be safely stated now, is sufficient to cover the disability benefits provided for therein. It is not provided for therein to cover benefits payable on any disability claim alleged as total for six months. That assumption has, however, been made by many companies in computing rates and, while possibly endangering premium sufficiency, certainly has the merit of reducing the possibility of disputes; but when that six months is reduced to three, extreme care should be taken because there are many temporary impairments introduced. The premium should be ample to provide for these.

The feeling of some is that the premiums charged by some companies issuing the three months' clause are hardly sufficient.

MR. BOWERMAN: Mr. President, I was invited to offer a few remarks on the general practice of companies with respect to adding disability and double indemnity benefits to existing policies.

I see no objection to it, if you use the proper safeguards, making sure that the applicant is now insurable for that class of benefit. I do not think it desirable, however, to add disability benefits to a policy that was issued before the Company began granting that particular kind of disability benefit to new policies.

We add disability and double indemnity benefits to existing policies upon satisfactory evidence that the applicant is now insurable for such a benefit providing we granted such benefits to new policies at the time the existing policy was originally issued.

A very interesting article by John S. Thompson giving various suggestions as to the proper way to compute the cost of adding these benefits to existing policies will be found in T. A. S. A., XXIII, page 204.

With regard to the proper limit of monthly life income per $1,000 of insurance, I agree with the previous speakers that $10 is sufficient for that purpose.

In determining the advisability of limiting the amount of disability benefits granted at the younger ages at entry it seems to me we should take into consideration the earning power of the young man desiring the insurance. A boy of fifteen going to school is earning nothing; I do not see why he should have a large income coming in if he should be disabled. A man or boy ought not to be granted so much disability benefit insurance that it would be more profitable to him to be disabled and draw his monthly income during disability than not to be disabled at all.

Instead of providing for increased benefits five or six years after the claim has been incurred, I think we ought to widen the disability provision so that more people could get the benefit of it. I referred to this matter on pages 200 and 201 of the *R. A. I. A.* in Volume VI, Part II, published in November, 1917.

Mr. Coler: If I may, I will take the sub-topics about which I desire to speak in reverse order.

I didn't have sufficient time to do more than look up our own disability experience for the last year. That involves one hundred and thirty-five millions of dollars of average exposure.

I might say for the information of those who may not know with what company I am connected, this is in the Maccabees, a fraternal society.

This business was issued between 1884 and 1904. All of it has disability benefits. The issues of '84 to '87 provided for the payment of one-half of the certificate upon total permanent disability or upon attaining age 70; so that 70 is the limiting age. The issues from '88 to 1904 provide for the payment of one-tenth annually of the amount of the certificate until three-quarters has been paid to the member upon his total permanent disability.

By a ruling of our own in the office, we have assumed that on this class of certificates the attainment of age 70 would be proof of total permanent disability. The total average exposure last year was one hundred and thirty-five millions of dollars. No waiver of premium is included in the benefit; a man goes on paying his rate even when drawing benefits; so I think you will be interested to know that last year our incidence of disability, actually disabled claims was only 46 per cent of those expected by the Hunter table.

I have been unable so far to analyze the mortality. As far as the total was concerned for that type of benefit, it was more than ample. In previous years the experience has been much less than expected; last year we made very careful calculations and found it was forty-six per cent.

Now, as to (*d*): "The insertion of a clause providing for increased benefits five or six years after the claim has been incurred:" I have had a great deal of correspondence the last two years with disabled members, and there is no doubt in my mind that the need for benefits is greatest soon after the claim is allowed or soon after the disability is incurred. There is a type of disability, too, that, after it has survived for five years as a total disability, seems never to die.

I fear that any general adoption of increasing the annuity would be disastrous. There are, of course, a number of short term deaths among disabilities, but not nearly as many among the advanced ages as one would think. You get the disabilities from rheumatism and tuberculosis and what so often the doctors call general debility and heart diseases in the fifties and sixties, but a great many of them stay that way a long time.

MR. M. W. TORREY: In considering the question as to whether or not rates based on Hunter's table are sufficient, I think we should bear in mind most strongly that Mr. Arthur Hunter's tables were not intended to be used in connection with a three months' elimination clause. I think that the limited experience of the companies in connection with the old form of disability clause can be used as proof that Hunter's tables are sufficient even, with the addition of the extra premium, for the three months' sickness where disability does not last longer than six months.

In this connection, our experience under a disability clause, where the first payment is deferred six months, may be interesting. Our first year claims were 63 per cent of the expected, and the second year 91 per cent. Our experience was made up on the basis of policy years per $1,000 of insurance, and we have included in the first and second year claims such claims no matter when reported. Thus, if a first year claim was not reported until the second or third year, it was included in the second year claims. Therefore, the percentages above quoted are subject to increase as additional claims may be reported from time to time. Mr. Hunter on page 27 of No. 5 "Actuarial Studies" shows that the ratio of actual to expected Disability claims should be about 10 per cent the first year, 52 per cent the second year and 70 per cent the third year.

I have some other figures that may be of interest. At age 35 the rate, according to Cammack's tables, is $1.85; according to Hunter's tables is $1.46, and to Hunter's table has been added the A. H. J. rate. At age 55, according to Cammack's, the rate is $4.16; the similar Hunter's rate plus the A. H. J. rate is $3.21. At these ages, 35 and 55, the ratio of Cammack's to Hunter's is about 124 and 129 per cent.

I may state that the company with which I am connected has a very definite conviction, that the future cost, under a three months' elimination clause, is going to at least approximate Cammack's table.

Now, with reference to section (*b*) What is the proper limit of monthly life income per $1,000 of insurance for the permanent and total disability benefit, there is one thing we must not forget, and that is, if we go too far we are liable to have some insurance department say that we are issuing accident and health insurance and should therefore embody the standard provisions in our policy. We have gotten away with it all right up to now, but if the increasing of the benefits is continued it will be only a question of time, in my judgment, when some insurance department will say that it is accident health insurance. I refer, of course, to $25 a month with the three months' elimination clause being similar to accident health policies which have a thirteen weeks elimination period.

Mr. Mead: With reference to the first question, I might say that our own attitude is diametrically opposed to Mr. Robertson Hunter's. We feel safer and surer as to what constitutes an adequate rate for double indemnity than for disability. We freely add double indemnity to existing policies; we are much more strict with reference to disability benefits. With reference to the latter we are dealing with a very complicated subject and, in addition, we know but little as to the true rate of disability.

Someone referred to the death rate among those disabled from tuberculosis. It all depends on your attitude, what your death rate will be. Our Company is very liberal; the mere fact that a policyholder has given up work and has taken up the business of curing himself of tuberculosis is considered prima facie evidence as to total disability. The death rate in such groups will be considerably less than among those absolutely compelled to give up their occupation on account of tuberculosis.

It seems to me we ought to charge a sufficient premium and give the service; and if we do give the service the cost will be much higher.

I am glad that Mr. Coler referred to the benefits granted by the Maccabees upon whose experience Hunter's tables were based. They did not grant waiver or anything in excess of the face of the policy but simply a deduction from the face of the policy in case of total disability. We are going far ahead of that, granting waiver of premium and substantial benefits, such as the monthly income, and so on; we will get an entirely different experience. Furthermore, I don't believe with one hundred and thirty-five millions of insurance where the probability of the casualty is so small any one year's experience is any guide whatever. You all know that the greater the probability of an event happening, the less deviation you have, and vice-versa.

I would like to ask Mr. Torrey: Your experience was 63 per cent?

MR. TORREY: Yes; our experience on first year claims.

MR. MEAD: Now, that is a very heavy ratio, especially when it is recalled that the intensity of selection with reference to disability is much greater than it is for life insurance, that the rate the first year is only 10 per cent of the ultimate, according to Hunter's compilation; therefore your experience is several times Hunter's tables.

MR. TORREY: Many times.

MR. MEAD: One large company gave its experience as about 80 per cent of Hunter's table. There is a large bulk of first, second and earlier years in their exposure. It seems to me it must necessarily follow that that company's ultimate experience will be far in excess of Hunter's tables.

I want to reiterate that this subject is more complicated than anything else with which we have to deal. If the company wishes to be successful it should be liberal and free but it should charge an adequate rate. I believe the disability premium should pay its way; the benefit ought to stand on its own bottom and not be considered as an advertising feature but a proper premium should be charged for it.

As to the proper limit of disability income per $1,000, it seems to me 10 per cent, or, as some companies have it, one per cent a month, is quite sufficient. Some companies are doubling this; I think we are going to fall into the maelstrom of the health and accident insurance by pursuing the subject too far.

Our own company is very liberal in selection at the younger ages, because the rate of disability is quite light. It may surprise you to know that we are granting disability benefits down to age 10 on regular life insurance. We have no limits for life insurance at those younger ages. Of course we have limits for the individual case but we have established no general rule. The only source of disability in those younger ages is tuberculosis, and the great mass of those who have it at those younger ages are those who are uninsurable at the time of application. We expect to eliminate in selection most of those who will become totally disabled at those younger ages.

I am quite out of accord with increasing the benefits after five or six years. The intensity of need is at the start. It will transpire that there is a rapidly decreasing proportion of them live to receive those benefits.

I infer that subheading (*e*) was intended to imply "no charge for interest on premiums charged as a loan in case of disability occurring after age 60." It has been well brought out in the discussion that it is very difficult to determine after age 60 whether risks are totally and permanently disabled within the meaning of the contract. The rate will not only be very heavy but it seems to me we will have enough to keep us on our mettle by passing upon the claims which will evenually mature before age 60. At the younger ages the cost of waiver after 60 is comparatively light as is also true of waiver itself but at ages at entry above 50 the cost is surprisingly high, very high indeed, and so far as I am aware there is no company granting this waiver without interest after age 60 that is charging an adequate premium for the benefit. Furthermore, we are all aware that there are no mortality salvages in the average company after the first three or four years in case of entrants above age 50, according to the American Table, and therefore we should not increase the burden on the premiums at these ages.

MR. GRAHAM: I received a letter from Mr. Hunter which I know you will all be interested in hearing. It is with reference to subdivision (*f*) of this topic. Mr. Chairman, with your permission I desire to read this letter.

> "I am sorry that I shall not be able to attend the fall meeting of the American Institute of Actuaries. You are probably aware that the meeting of the Medical Directors' Association is on the same two days in New York and as Dr. Rogers and I have a paper to present we would naturally like to be present.
>
> In the list of topics for informal discussion I notice that "4 (*f*)" refers to the basis for disability premiums. When that question comes up for discussion you might say that the New York Life has made an addition to the net premiums on my disability tables in order to cover the cases which will exist for three months, but are not in the nature of permanent disability. While we have

> had the three months' clause for a short time only, we are satisfied that the premiums charged by us are sufficient to cover the Company under present conditions."

One other subdivision I would like to express myself in connection with: (*c*) "Advisability of limiting the amount of disability benefits granted at the younger ages at entry." At these younger ages a life income benefit can not be granted on the basis of the earning capacity of the life, neither can we find any justification in most of the cases where we grant life insurance benefits for the benefits that we place on the risk when we issue our policies. Yet, while I agree that we must proceed conservatively in connection with this benefit, I do not believe that the granting of this disability benefit at the younger ages is a very serious problem.

MR. ANDERSON: It seems to me it is important to know what coverage of similar character a man carries in other companies. I recently recommended to my company that two questions be added to our application, one being as to the income of the applicant, drawing a distinction between income and earnings. For instance, one who has a large amount of bonds can get some one to clip his coupons whether he is disabled or not; so we make a distinction between income and earnings. The second question in the application refers to the kind and amount of similar protection carried in other institutions.

MR. MEAD: It strikes me as an absolute limitation to not issue more than $25,000 with income disability, just as a matter of company protection. On those larger claims there are likely to be difficulties even if the men are able to carry that amount of disability insurance.

With reference to the small policyholder, I think his purchasing power is the limit possibly.

MR. FLANIGAN: I think there is discernible today an attitude that the disability is all right, and I am in agreement with most of the speakers; on the other hand I don't think that we should be stampeded to restrict its service. Mr. Mead made one remark that I am afraid may be misconstrued: that is in reference to the ratio that the Metropolitan has had. If

I understand this disability proposition, it is entirely possible for a company to have a ratio actually well over 100 per cent and still not be losing money on it. In other words, if these claims after they are admitted run off in a shorter time on the average than Hunter's tables represent, it is still possible to have 100 per cent, or greater. I think it is well to bear this in mind in connection with disability. I don't know what the Metropolitan death rate on disabled lives was or how far they went in admitting claims.

The question was raised of the man who could no longer *follow his occupation*. Our company has been using such a clause, but we found it necessary to limit it to well-defined occupations, professional or executive, that were not apt to change. We are charging regular rates, with just twenty cents on each thousand dollars extra. We are using safeguards such as the questions Mr. Anderson mentioned: we have found them so valuable that we are going to put them in all our applications.

I would like to remark about the rates on Hunter's table. We adopted in our company the three months' provision very nearly two years ago, and we tried to work out a rate to provide for the temporary claims we expected to get, for which Hunter's table does not provide. I haven't made a thorough analysis of our claims, but I am satisfied that the number of temporary cases admitted represent quite a bit more than the number of cases admitted under the old permanent six months' clause. Of course the duration would be relatively smaller. At a guess, I would say probably twice as many temporary claims as permanent.

MR. MEAD: Every one of those will consume a great lot of premiums, though.

MR. FLANIGAN: Yes; I think on the average those temporary claims run about six months. You must make some provision other than made in Hunter's table for the temporary claims, when you adopt the three months' clause.

INFORMAL DISCUSSION

SUBSTANDARD INSURANCE

(*a*) Basis of premium rates for substandard insurance.

(*b*) Has the ratio of actual to expected mortality where the rating was based on accepted statistics been found to differ materially from the ratio on substandard classes where there were no statistics for determining the ratings?

(*c*) Disability benefits on substandard lives.

MR. F. S. WITHINGTON: There are two main elements which should, it seems to me, be the foundation of all discussion of substandard insurance. The first of these, and I think it will be recognized as the more important, is the classification of the risk by the rate of mortality.

This is by far the most difficult problem any company will have in its handling of substandard business. While we have increasing data on which to base our judgment in the placing of these risks in their proper class, it will always be a difficulty which can only be overcome by men of experience and ability in that special line, whether the man be the actuary or the medical director, and it should not be attempted by any company, as has been pointed out in various papers, unless that company shall be equipped with the necessary actuarial and medical experience.

In this connection I want to express appreciation—and in doing so I feel sure that I reflect the sentiment of all those here present—for the generosity of the New York Life Insurance Company evidenced by the publication of its experience in detail with various classes of substandard business. It seems to me that this cannot be too highly commended, and I think it is fully appreciated, as it should be, by all who have occasion to consider and study this phase of our business.

The second fundamental element in this question, I believe, is the fixing of premium rates, reserves and surrender values, and the basis on which these should be calculated.

In my opinion, these two elements should be kept entirely separate and distinct. It is the failure to so spearate them which has I am convinced led to so much uncertainty, hesitation and indecision regarding the proper method of their calculation.

Now I think it is generally acknowledged that the Medico-Actuarial or the American Men Table, preferably the latter, must usually be depended upon to find the extra rate of mortality, as compared with the rate among standard lives, in any special class of extra-hazardous risks. The reasons for the preference for the American Men Table need not be mentioned here, but it is valuable for that purpose. We must have a table which represents, as far as possible, the actual present rate and trend of mortality among insured lives, in order to make a proper comparison between the actual rate, as found by special investigation in various classes of substandard lives. But, in my opinion, we should not and can not use any other basis than the legal standard in making our premiums and reserves and surrender values; and that standard is, generally, the American Experience Table. If the legal aspects of the subject are kept clearly before us I believe we will avoid confusion of ideas regarding these matters.

The basis and methods of determining the extra rate of mortality are not fixed by any law. The company can legally use whatever basis and methods it chooses for that purpose; and there is where the liberality or illiberality of the treatment of substandard business can come in. The basis and method must be left to the individual judgment of the company's actuary and medical director, but, having once established the classification according to rate of mortality by whatever basis or method, we must, I firmly believe, use that percentage or rate of extra mortality as a multiple of the American Experience Table or the legal standard.

Now, I am not claiming that the American Experience Table is a perfect table. It has its defects just as any other table has its defects. No table of mortality can possibly be made perfect in all respects. It is merely a standard of measurement, representing an average rate of mortality which has been proved to be eminently safe and conservative. As a matter of fact the American Experience Table is, on the whole, much more conservative than the American Men Table.

In order to illustrate this more clearly I would like to introduce as a part of this discussion a short comparative table of the rates of mortality (q_x) between the American Experience and the American Men Tables. I beg to present the same herewith for the RECORD.

In order that those unfamiliar with the actuarial aspects of this subject may not misconstrue or draw a wrong conclusion from the comparison given in the table, I will explain that the difference in the net premiums calculated by both the American Experience and the American Men Tables would be, on the average, roughly speaking, only about one-half of the differences in the rates of mortality shown in the table. Mr. Henry Moir, by the way, has very clearly stated this fact in a reported discussion of this subject at the recent meeting of the Actuarial Society of America. It may also be advisable, for the same reason, to state that the corresponding reserves by the American Men Table would be, on the average, and as a rule, larger than the reserves by the American Experience Table, now in use by the companies, notwithstanding the fact that the net premiums would be smaller.

It will be seen by this comparison, which I have reduced to percentages of the American Experience Table q_x, that the American Men Table shows a considerably lower rate of mortality at ages younger than 61, than does the American Experience Table. This difference progressively decreases until age 60. From ages 61 to 68 the American Experience rate of mortality is very slightly lower than the American Men Table rate, while from ages 68 to the table limit, it becomes increasingly and progressively higher than in the American Men Table.

While those differences would seem to demonstrate that the American Experience Table does not follow strictly the present facts as far as curve or incidence of mortality is concerned, it will be seen, I think, that on the whole the rate of mortality by the American Experience Table is much safer and more satisfactory as a basis for premiums for substandard business, because, as I have always maintained, it is absolutely

COMPARISON OF MORTALITY RATES, AMERICAN EXPERIENCE AND AMERICAN MEN TABLES

Age	Am. Exp. 1000 q_x.	Am. Men (5) 1000 q_x.	Diff.	Diff. % of Am. Exp.
15	7.63	3.46	4.17	54.7
16	7.66	3.53	4.13	53.9
17	7.69	3.63	4.06	52.8
18	7.73	3.71	4.02	52.0
19	7.77	3.81	3.96	51.0
20	7.81	3.92	3.89	49.8
21	7.86	4.02	3.84	48.9
22	7.91	4.12	3.79	47.9
23	7.96	4.18	3.78	47.5
24	8.01	4.25	3.76	46.9
25	8.07	4.31	3.76	46.6
26	8.13	4.35	3.78	46.5
27	8.20	4.39	3.81	46.5
28	8.26	4.41	3.85	46.6
29	8.35	4.43	3.92	46.9
30	8.43	4.46	3.97	47.1
31	8.51	4.48	4.03	47.4
32	8.61	4.51	4.10	47.7
33	8.72	4.59	4.13	47.4
34	8.83	4.68	4.15	47.0
35	8.95	4.78	4.17	46.6
36	9.09	4.94	4.15	45.7
37	9.23	5.12	4.11	44.5
38	9.41	5.32	4.09	43.5
39	9.59	5.56	4.03	42.0
40	9.79	5.84	3.95	40.3
41	10.01	6.16	3.85	38.5
42	10.25	6.54	3.71	36.2
43	10.52	6.94	3.58	34.0
44	10.83	7.42	3.41	31.5
45	11.16	7.94	3.22	28.9
46	11.56	8.52	3.04	26.3
47	12.00	9.18	2.82	23.5
48	12.51	9.89	2.62	20.9
49	13.11	10.70	2.41	18.4
50	13.78	11.58	2.20	16.0
51	14.54	12.54	2.00	13.8
52	15.39	13.62	1.77	11.5
53	16.33	14.78	1.55	9.5
54	17.40	16.08	1.32	7.6
55	18.57	17.47	1.10	5.9
56	19.89	19.02	.87	4.4
57	21.34	20.69	.65	3.0
58	22.94	22.51	.43	2.0
59	24.72	24.49	.23	.9
60	26.69	26.68	.01	.004

COMPARISON OF MORTALITY RATES, AMERICAN EXPERIENCE AND AMERICAN MEN TABLES.—*Continued*

Age	Am. Exp. 1000 q_x.	Am. Men (5) 1000 q_x.	Diff.	Diff. % of Am. Exp.
61	28.88	29.03	+.15	.05
62	31.29	31.58	+.29	.9
63	33.94	34.37	+.43	1.3
64	36.87	37.38	+.51	1.4
65	40.13	40.66	+.53	1.3
66	43.71	44.18	+.47	1.1
67	47.65	48.03	+.38	.8
68	52.00	52.16	+.16	.3
69	56.76	56.64	.12	.2
70	61.99	61.47	.52	.8
71	67.67	66.70	.97	1.4
72	73.73	72.33	1.40	1.9
73	80.18	78.39	1.79	2.2
74	87.03	84.92	2.11	2.4
75	94.37	91.94	2.43	2.6
76	102.31	99.51	2.80	2.7
77	111.06	107.65	3.41	3.1
78	120.83	116.31	4.52	3.7
79	131.73	125.69	6.04	4.6
80	144.47	135.74	8.73	6.0
81	158.61	146.42	12.19	7.7
82	174.30	157.87	16.43	9.4
83	191.56	170.05	21.51	11.2
84	211.36	183.15	28.21	13.3
85	235.55	197.07	38.48	16.3
86	265.68	211.80	53.88	20.3
87	303.02	227.29	75.73	25.0
88	346.69	244.08	102.61	29.6
89	395.86	261.70	134.16	33.9
90	454.55	280.35	174.20	38.3
91	532.47	299.46	233.01	43.8
92	634.26	321.08	313.18	49.4
93	734.18	341.88	392.30	53.4
94	857.14	363.64	493.50	57.6
95	1000.00	387.76	612.24	61.2
96	1000.00	411.11	588.89	58.9
97	1000.00	443.40	556.60	55.7
98	1000.00	457.63	542.37	54.2
99	1000.00	500.00	500.00	50.0
100	1000.00	562.50	437.50	43.8
101	1000.00	571.43	428.57	42.9
102	1000.00	666.67	333.33	33.3
103	1000.00	1000.00		

essential for us to have at least the same relative gain from mortality on the substandard as from standard business, in order to do the business at a satisfactory rate of profit and with entire safety to all policyholders. But, whether we think we need that gain or not, we must, in my opinion, base the premiums on the American Experience Table, for the reasons I have given.

Now it should not be so much the concern of a company as to the reserves which should be set aside on substandard business, as it should be to fix the premiums or the amount of money which the company is going to get from the insured to carry the risk. That is the first consideration which would be in my mind as an actuary of a company. I think if that is properly fixed, the reserves and surrender values will take care of themselves by the usual legalized formula.

As far as participating and non-participating policies are concerned, I do not think that there should be any difference in the basis or method of computing net premiums. The difference should be a matter of loading on the net premiums, and it is in the fixing of the loading and of dividends on participating policies that the American Men Table can also be used to great advantage. In that connection also I want to refer to Mr. T. A. Phillips' discussion at the last meeting of the Institute, in the matter of determination of dividends on substandard policies. I think that his suggestions in that discussion (Page 213 of the RECORD of June 1922) are most valuable and pertinent, and can be followed with entire safety and satisfaction.

There is another aspect and point in connection with this subject which seems to have been overlooked. It has not, to my knowledge, been mentioned in any of the papers or discussions. It is the fact that we have anti-discrimination laws in all the states of this nation except the states of Georgia and Nevada and in the District of Columbia, the language of one paragraph of these laws being practically indentical in all of these states.

In order to bring this more clearly before the meeting, I want to quote an extract from the Illinois law. This reads as follows:

> "No life insurance company or association organized under the laws of this State, or doing business within the limits of the same, shall make or permit any distinction or discrimination between insurants of the same class and equal expectation of life, in its established rates; nor in the charging, collecting, demanding or receiving of the amount of premium for insurants of the same class and equal expectation of life; nor in the return ratably of premium, dividends or other benefits, accruing, or that may accrue, to such insurants as aforesaid."

There is very slight variation in the phraseology of this law in the states which have enacted it. The California law, for instance, reads as follows:

> "No life insurance company doing business in this State shall make or permit any distinction or discrimination in favor of individuals between insurants, (the insured), of the same class and equal expectation of life in the amount or payment of premiums or rates charged for policies of life or endowment insurance, or in dividends or other benefits payable thereon, or in any other of the terms and conditions of the contracts it makes."

If these laws mean anything, it seems to me obvious that they mean the company must base its premiums on the rate of mortality, and that such rate is the governing factor. That means, then, that we can not give to a substandard insurant a benefit equal to that which we give the standard insurant.

Those laws, in connection with the fact that we have a legal standard for net premiums and reserves, would seem to fix the procedure which must be followed in handling substandard business. In other words, we can legally use any table we like, or any reasonable and consistent method we like, to determine the rate of mortality; but, having once determined that rate, we must base our premiums and equivalent benefits on the said rate and on the legal standard prescribed in the statutes of the states in which we are doing business.

It is not a question of what we now prefer as a legal standard. That is fixed for us by the state statutes, and it is quite obvious to me that there will be no change in the fundamental and legal standard of mortality for a good many years to come, particularly in view of our experience during the influenza epidemic.

Finally, let me say that I trust we will not allow our desire for the adoption of a theoretically exact standard of mortality to cloud our better judgment in these matters.

MR. LEWIS ALBERT ANDERSON: A short time ago I received a letter from Mr. Parker asking me to prepare to discuss this subject. At the outset I want to say that I am connected with a company that has had but little experience in dealing with this class of business, and, secondly, I approach it not as one familiar with the subject but as one who has not had the opportunity to work out its details and study it and therefore seeks light and needs light.

I also received a copy of the report issued by the committee on substandard insurance a short time ago, and to me it looks like a very creditable piece of work.

As I view this whole question, it divides itself into a few general headings. Let me say that while we have had a great deal of analysis, and we ought to have more, we really need to reduce this mass of information to a few general groups. One way to deal with it is to add a constant percentage to the q_x, assuming that that would represent the mortality on this class of risk. Another way is to use special mortality tables divided under various heads; such as standard, substandard and intermediate. It stands to reason that the mortality in such tables would take a different turn from that of a flat table or any one of the standard tables now commonly used.

At present I am rather inclined to favor the first method, for three reasons. First, because of its simplicity; second, it could be used more economically in the handling of the business; third, it makes a ready comparison, makes it easy to determine how the experience proves to be under that class as compared with standard risks.

In that connection I want to remind you of the paper that was presented at the seventh International Congress of Actuaries, by Dr. Gustave Du Pasquier of the University of Neuchatel, Switzerland, wherein he shows you the four groups, and which I think is worth while for us to study.

Coming to (*b*), that brings up what I said at the outset, that we have had very little experience in my company with that class of business. But as far as our observation goes, we have had no adverse experience with it. In other words, the premiums we charged have been adequate.

Under (*c*) "Disability benefits on substandard lives," I will say, off-hand, no; although I can see where possibly a few cases might be taken, but they would be the extreme. For instance, you might take an office man, like a newspaper editor who had lost one hand, and is in position to have a chauffeur take him to the office. There would be no reason, it seems to me, why we should not grant such a man disability benefits, and yet just such men are exposed to the hazards of the automobiles, elevators or street cars, and being disabled they would be at a disadvantage in case of accidents.

With those general remarks I will leave the subject in your hands to hear from those who are more familiar with it.

MR. PATTISON: I wish to confine what I have to say on this subject entirely to section (*a*), "Basis of premium rates for Substandard Insurance."

Those of you who were so fortunate as to be with us last June will remember very clearly Mr. Phillips' remarks on this topic. I was much impressed with those remarks; in fact, after I heard Mr. Phillips, I thought that the last word had been said on the subject of rates for substandard insurance. I have since had the opportunity of reading those remarks in the RECORD, and am still greatly impressed with the thoughtfulness underlying them.

Mr. Phillips approached the topic from the viewpoint of the participating or mutual company, and showed that the extra premium for the substandard policy could be so assessed that the dividend to the holder of a substandard policy would be the same as the dividend to a holder of a standard policy, issued at the same age. If a company transacts only a small amount of substandard business, this plan may work out very conveniently in practice, and may eliminate a considerable portion of office work; but I do not believe it would prove to be a very good basis for our substandard rates if we were to handle a large amount of this class of business.

I believe the same relation obtains between standard and substandard insurance as does between insurance at age 20 and at age 50. Your applicant at age twenty pays a certain contribution to your mortality fund, and a certain contribution to your expense fund, and a certain contribution to your reserve and other funds. Your applicant at age fifty pays a different contribution to your expense fund, and a different contribution to your mortality and reserve funds. If there is any justification in your applicant at age fifty paying a larger contribution to each of these funds than your applicant at age twenty, then it is plain that the applicant for substandard insurance should pay a larger contribution than the applicant for standard insurance.

It is a little hard for me to expresss myself clearly on this subject, even though my ideas on it are very clear indeed.

I believe we could carry this illustration a little further. The man who applies for and receives a substandard policy is in exactly the same relation to the company as the man who takes out a standard policy, and the rate applicable to him should be assessed as if he were age 50, say, instead of his actual age of 20, and that illustration would carry through whether the man had a participating or a non-participating policy. It would be logical, it seems to me, to assess the substandard rate in such a way that it would bear the same relation to the risk assumed as the standard rate bears to the risk assumed under a standard policy. If we did this, it would be necessary to have a separate dividend scale for substandard classes, just the same as we have a different dividend scale for the applicant at age fifty and for the applicant at age twenty.

If it is proper that we should base our rates for standard insurance on the American Experience Table, then in order to produce equity between our standard and our substandard policyholders, we should base our premiums for substandard insurance upon some substandard table of rates, either formed from a multiple of the American Experience q_x, or which will correspond in some similar way to the American Experience Table.

If a company bases its premiums on the American Men Table for its standard insurance, then it should base its premiums for substandard insurance on a special table, either formed from a multiple of the American Men q_x, or which bears some similar relation to the American Men Table.

We could group our substandard insurance both for dividend and reserve purposes. We could create many different classes in our substandard insurance. We could group them under A, B, C, and have as many groups as we want, but each of these groups should be kept separate for the purpose of dividend distribution and the mortality under such a group should be measured by a multiple of the table which we use for our standard business, otherwise we are not going to have any relation at all between our standard and our substandard business. It would seem practical for a company, starting out to write substandard insurance, to use for its substandard group "Table A," rates based upon 125 per cent of the American Experience Table q_x. Then, as its experience showed that the results in this group would warrant a reduction in the rates charged, this could properly be reflected in the dividends paid to the group.

It occurred to me in reading Mr. Phillips' paper that it was very difficult to determine the exact additional cost of a substandard group, and that it would seem reasonable to be on the safe side in the handling of this business even more than on the standard group. It would certainly seem to be the conservative course to load the substandard group a little more than the standard group, instead of following the line followed by Mr. Phillips, that of merely covering the net extra cost. I believe that substandard insurance should pay its own way, and I don't believe that we should relieve it of any of its share of either the expense or the mortality.

The main point that I am trying to bring out is that the premiums for our substandard insurance should be so loaded as to bear a reasonable relative increase over our standard insurance premiums.

MR. MEAD: To relieve Mr. Pattison of any anxiety he may have, I want to say that I for one believe he has very aptly expressed what he had to say.

In connection with this subject under discussion, let me say that we should not attempt to transact a substandard business on a radically different basis from that on which we transact standard insurance business, and we should have the same relative charges for substandard insurance that we have for the standard insurance. To my mind the main thing is to charge sufficiently for it and then give the service.

I have seen the rates of some companies recently which especially surprised me in view of the fact that, while they were doubtful about entering the substandard field for so long, when they do they are afraid to charge what they equitably should and throw the burden on the standard risks.

The impression seems to have gotten among some of the companies that by using a multiple of American Men ultimate, with some slight loading, they will have some margin to draw from during the period of selection. I think if any are counting upon any such margins they will be deceived, because in the first year all such margins will be consumed by the expense. There may be some such margin during the second year, but from the third year on there is a big hump in the curve and thus there will probably be no margins from using the American Men Table ultimate as a basis.

I noticed recently that one company had loaded the multiple of the American Men ultimate only 20 per cent at the younger ages and at the higher ages loaded only 12½ per cent. I think that where we need the largest loadings for fluctuations and excess cost is at the higher ages, in view of the fact that we have practically no margins on the standard business.

I should say the main thing is to charge sufficient premiums and not throw the cost back on the standard insurance.

It is not to be presumed that any one may so delight in the forensic as to advance the specious argument that one should not criticize the sufficiency of the premiums just referred to without some knowledge as to the composition of the risks that are placed in the classes to which the ratings correspond. Some types of ratings are pretty well standardized by this time. For instance, the average mitral regurgitation with little or no hypertrophy is almost universally looked upon as a 175 per cent risk both in view of the statistics on the subject and the most advanced underwriting judgment. Would it not extremely complicate the machinery of a company and blur its perspective if it were to put similar and like risks in, say, higher percentage groups owing to the fact that it was aware that its loadings for contingencies, expenses and margins were insufficient?

Mr. C. O. Shepherd: I am very much inclined to disagree with the theory that because we determine our extra premiums by a multiple q_x table, consistency requires that we use the same table for computation of reserves.

When we set ourselves the problem of determining substandard premiums we face the fact that the types of risks we want to insure vary not only in degree of extra mortality which they will produce, but vary much more strikingly in respect to the incidence of mortality. In both respects our knowledge is very limited and practical considerations prevent fine distinctions between different types.

The use of a multiple q_x table very naturally suggests itself, particularly on account of the fact that the best information we have on the better known types is in the form of a comparison of the number of actual deaths with the number of expected deaths according to a standard table, over a very limited period. We all know that a table so constructed does violence to the facts in some cases, but no more so probably than any other single table which we could construct. It serves our purpose in enabling us to determine adequate premiums that are reasonably equitable and that is the all-important thing in dealing with substandard business in its present stage of development.

When we come to computation of reserves, incidence of mortality is very important and of much more weight than it is in computing annual premiums. If we modify our reserves for one type, we will make them farther out of line than ever for another type. As I have said, practical consideration prevents us from making fine distinctions and differentations into many classes.

And the difficulty is not merely a temporary one that we may hope to dispose of at an early date with more experiences at hand, it is a condition which will always exist to a large degree. Just to the extent we advance and improve our knowledge of selection, just to that extent do we make our past experience unsuitable as a guide to our future experience. We shall learn to accept new types and learn better methods of selection of the types we now consider. Medical knowledge will advance, treatment of disease will be more effective and the public will learn better how to live. The future suggests changes in every direction.

Reserves computed according to a multiple q_x table are in all probability excessive—an error on the side of safety and by all means whatever method we use, safety should be a first consideration. Excessive reserves are objectionable however because on account of our statutes excessive reserves mean inevitably excessive surrender values.

We tell the applicant for one of our standard policies that he belongs to a class carrying a heavier mortality than the normal and that we cannot give him a standard rate. Why should we not offer him a policy identical with our standard policies or as nearly identical as possible except for the addition of a rate adequate in our best judgment to meet the extra mortality.

Mr. Mead: If you expect 150 per cent mortality on types of substandard risks where you have statistics, where you have some experience of ratio of mortality, are you equally successful in assuming 150 per cent where you really haven't any statistics? I might say that our experience in individual groups is not large enough to answer that question. But taking our substandard groups as a whole we have been quite successful. Although we have had a peculiarly favorable experience on some types our experience on other types was not so favorable. That may be due to abnormal loss on one hand, and on the other hand it may be due to the fact that our type of business is entirely different from the experience of other companies.

I think that any other companies' experience will have to be used with caution and care, and I rather gather from the meeting that was held recently that the generally accepted view was that it probably would not be satisfactory to judge entirely by the experience of any one company, but rather by the aggregate experience of a group of companies under various types of impairment.

Mr. Buttolph: It seems to me that we are not getting any very clear conception of this proposition, and we can't get a clear conception of it until we adopt what you might call a universal language. We are talking in many languages in our discussion of substandard insurance. There has been mention of 150 per cent and 200 per cent. Of what? One speaker here may mean 150 per cent of the American Experience Table, another may be referring to 150 per cent of the American Men Table, and still others may have in mind 150 per cent of some other table not known to us. I say it is all too indefinite.

We talk about loadings. One of the speakers has just referred to it, and I want to remind you of the fact that loadings are not always very consistent even in the same company, and they certainly are not the same in various companies. It seems to me to be a very difficult question to talk about.

One of the gentlemen in a general way rather condemns the rates of some other companies. What does he know about what "Class A" in some other company means? Class "A" might be defined as 150 or 175 per cent but, beyond that, does he know the risks that the company puts in the 150 or 175 class? I think not. We have standards of classification that vary greatly. The company that has this altogether too low rate may be really charging for the individual risk a great deal more than the speaker would admit is necessary to charge.

I have my own ideas as to a proper method of computing premiums on standard risks. I agree with the speaker who has said that the computation for rates on substandard risks should be more or less consistent with the individual company's practice in standard risks, and according to the way that company expects to classify its risks. Rates for substandard risks should be consistent with rates on standard risks. It is easily possible that a company writing standard risks will fully recognize the laws to which our attention has been called regarding valuations and discriminations, and yet ignore absolutely true mortality experience, in computing its gross preiums.

I really don't see that a discussion of this topic as set out in the program can get us anywhere. It seems to me that to compare notes is what we need; and in order to get any really definite information as to what the other fellow is doing on this subject, we must sit down with him and go through a very considerable amount of detail, and there will have to be evident much more frankness as to just exactly what we are doing in this matter, than I have noticed up to date.

Reference has been made to the antidiscrimination laws, and the danger of falling foul of those laws. I can't see that there is any force to that at all. The laws, it seems to me, are so drawn and so intended that they present no stumbling block at all in this matter.

The statement was made here that only in a few very unusual cases would it be safe to grant disability benefits in substandard cases. Bearing in mind fully what I have just attempted to say regarding our liability to misunderstand each other when talking about this subject, I regard a substandard case as any case which by any means is charged a different rate for a similar policy than the standard rate.

We find that in our first classification of substandard business—and by that I mean the class in which we charge the smallest amount of extra premium—a very large percentage of our substandard cases fall. And if our somewhat small experience to date is to serve as a reliable guide, then we are going to find that a great many more cases will fall in that class than in any one class of substandard business. A very large percentage of the cases falling in that first classification, I believe, are fully entitled to disability insurance. You may see fit to charge a substandard disability rate, but I don't believe it is necessary to bar all but a few exceptional cases from disability insurance.

THE PRESIDENT: Are there any further remarks on this subject? If not, we will move to the next subject.

INFORMAL DISCUSSION

REINSURANCE

(*a*) Advantages and disadvantages of reciprocal reinsurances arranged between a group of companies.

(*b*) What points must be considered when determining the limit of risk a company can retain on one life?

(*c*) What justification is there for having a larger limit under a policy with Double Indemnity than under a policy without Double Indemnity?

(*d*) How is the limit of companies affected in event of the policy containing a disability clause providing for payment of a monthly income and waiver premium?

Mr. W. O. Morris: With regard to a reciprocal arrangement for the exchange of reinsurance between several companies; if the companies are of about the same size, and if they are writing about the same amounts of new insurance, and if their methods of selection are nearly parallel, it seems to me that this would be an ideal solution of the reinsurance problem, because it would spread the risk, and retain for each of the originating companies a proportionate share in whatever mortality profit accrued from the business. But this ideal, like many others, is rather hard to attain. There are not many other companies the size of yours that are as well managed as yours. There are not many such companies that will grow as rapidly as yours, and if they do, they are not as conservative. So that a well-balanced group of companies, entering into such an arrangement, might find it difficult to maintain the balance. My observation is that the executive officers of our company are inclined to focus their attention on the obligations assumed and on the reinsurance premiums paid out, and the reciprocal factors of obligations transferred and reinsurance premiums collected are given much less consideration.

In determining the limit of risk a company can retain on one life, it seems to me that the considerations should be practical rather than theoretical. The principal thing to be considered is of course the financial ability of the company. Another point would be the agency organization. Other things being equal, a rapidly expanding company could retain a larger limit than a company of slower growth. A company which frequently receives applications for comparatively large amounts would be justified in retaining a larger limit than a company in which applications for such amounts are exceptional. Reinsurance premium rates would be an important point. The originating company can afford to purchase more reinsurance at the low premiums which can now be obtained than at the higher premiums required a few years ago. The age limits would have to be considered. Practical considerations lead most companies to reduce their retention at advanced ages. It is interesting to note that in theory the limit at older ages might be increased over the regular retention. I would not hesitate to recommend the retention of many times our usual limit, on an application for a whole life policy at age 96, charging an annual premium based on the American Experience $3\frac{1}{2}$ per cent rate, with our usual percentage loading. It would be necessary, however, to adjust the first year commission rate.

With regard to the limit of risk under a contract including the double indemnity benefit, the premiums collected for the double indemnity benefit should be sufficient to pay the double indemnity losses as they occur. From that point of view, the retention of some double indemnity risk, in addition to the usual limit under the life contract, would seem to be justified. I might say, however, that our company does not retain more than its usual limit in any case, under the combined benefits.

With regard to the waiver of premium and monthly annuity disability benefit, the additional liability incurred at disability will rarely exceed the face amount of the policy, and in my opinion a company is justified in retaining the full risk under the disability annuity provision, together with the life risk, up to its usual limit.

MR. M. W. TORREY: With reference to sections (*c*) and (*d*) I am heartily in favor of what Mr. Morris has said on those subjects. I can not see why a company should not carry at least fifteen thousand including the double indemnity, because the chance of loss is very small.

Mr. Buttolph: I would like to know what Mr. Torrey means by conservatism. It seems to me, that if you are going to take any double indemnity in addition to your limit on life insurance and carry it at your own risk, that it is a confession of one of two things: either that your limit for regular life insurance is lower than you think it ought to be, or that you are willing to take a chance.

When it comes to a similar question with reference to disability insurance, I feel very much the same way. I don't quite agree with what Mr. Morris said on that subject, if I got him right.

If you value your disability claims on the basis that I take to be the basis required by every insurance department—namely, the present value of the monthly payments that you agree to make, and the present value of the premiums which are waived—both computed on the basis of a recognized disability table, in the case of an ordinary life policy at age 35 the liability to which you will have pledged yourself, assuming a payment of ten dollars per month per thousand, will be $1112.00 per thousand, and on a twenty-payment life will be $1162.00 per thousand; and on the twenty-year endowment policy, if the monthly payments continue throughout life as they frequently do, the liability will be $1263.00 per thousand; and on the ten-year endowment will be $1456.00 per thousand.

It seems to me there is another way in which this thing could be computed. Let's discard theory and look at the practical effect. If we issue a policy with the disability benefit providing for waiver of premium and a payment of ten dollars per month per thousand, what happens from a purely practical and not at all theoretical point of view when that man becomes disabled? We have got to pay him $120.00 a year as long as he lives, and then have to pay the face of the policy when he dies with nothing coming in to the company in the meantime.

We are doing business on the assumption that we are getting around 3½ per cent on our invested funds. Suppose we adopt the expedient, for illustration, of putting into a special fund a thousand dollars, and we assume that we are going to earn $3\frac{1}{2}$ per cent interest or $35.00 a year until the man dies when we are going to turn over the principal to him. In the meantime we are not only going to pay him what we earn, but $85.00 in addition each year to make up the $120.00. Now taking that point of view, isn't the liability of the company considerably in excess of a thousand dollars? It seems to me that it is.

Even further discarding theory and carrying it to the extreme, we say we are not going to earn $3\frac{1}{2}$ per cent, we are going to earn 6 per cent. We find then that we have this thousand dollars tied up earning $60.00 a year and to be ultimately paid to the man, and all the income on it from year to year and in addition to that $60.00 a year must be paid to him.

It seems to me that it works out that way whatever point of view you may take, theoretical or practical. A policy with disability benefits issued for our maximum limit is going to impose a liability considerably in excess of our maximum limit.

Unless we have fixed our maximum limit in a way that Mr. Torrey advocates, we ought to take this matter into consideration in the determination of reinsurance.

MR. LEWIS A. ANDERSON: Speaking now on point (*d*). Our limit is $25,000.00 on a single life. A case came up a short time ago that was rather interesting. The policyholder had carried a large part of his twenty-five thousand for some 16 or 17 years. The total reserves on his policies amounted to about $7000, so that the net amount of risk was only about $18,000. The man appeared to be an exceptionally good risk. The question was, should we consider the face value of $25,000 as our limit or the amount at risk, $18,000. We felt also that this limit had been fixed a number of years ago when our business was much smaller, and our surplus was smaller, so we carried another $7000 on him on that theory.

I would like to hear from others on that question.

MR. LARUS: In answer to that question I would say that we have always subtracted the reserves on any existing policies before determining the amount we would carry on additional policies.

Mr. Phillips: I have rather assumed the position of a listener in this discussion so as to obtain the ideas of the "other man." I am tempted, however, to say a word or two on section (*a*), on the advantages and disadvantages of reciprocal reinsurance arrangements between a group of companies.

I have been struck with one thing in this connection which seems to be predominant in the minds of many here, namely, that in making a reinsurance arrangement with some other company, we are giving something away, and we therefore like to get an equal consideration in return. Of course there is something to that, but it expresses only a part of the relation between the two companies concerned. There is another phase to the matter, namely, the question of service. Certainly the company which is furnishing the reinsurance is giving a service—a service which is actually worth more than the pure mortality cost alone, and it may well be that if this service is sufficiently broad and adaptable and administered with a considerable degree of promptitude and uniform helpfulness, this second phase may outweigh the first in many instances.

The company that I happen to represent has placed reinsurance for a period of fifteen years under several different plans. We have operated on one plan whereby we gave our entire excess to one company; on another whereby we gave our entire excess to two companies, and on others in which we gave our first excess to one company and the second excess to another,—in each of these cases without receiving any business in return. We have had reciprocal contracts with a number of companies, both obligatory and facultative, under which we made cessions to these companies and in return received cessions from them; in that way receiving substantially as much reinsurance from them as we ourselves gave off. So that possibly I may speak with a little knowledge of what the difference arrangements for reinsurance really mean,—or at least meant to us.

I have come to the conclusion that reinsurance has a very large part of the element of service in it, and that whatever difference there is between the premiums we pay for reinsurance and the amount of money we recover for claims, is to a large extent the cost of that service.

That service covers a good many things. In a practical sense, as was brought out here today, it is a means of spreading your risks. It also permits the enlargement of a company's facilities, thus inspiring greater confidence and enthusiasm in the agency force. All of these things are a part of a reinsurance service and are worth something. I just wanted to bring out the fact that there is more than merely give and take in a reinsurance arrangement. If the coverage is broad enough to meet the insured's needs in all particulars and is helpfully and efficiently administered, I believe that *per se* we get full value received.

One arrangement that is frequently made between a group of companies might be described as a sort of incidental or occasional plan of cessions in which one company has the privilege of submitting to any other company and asking for insurance, and the second company may either accept or reject. Our own experience with a plan of that kind was not satisfactory principally because there was too wide a difference in the underwriting practices of the companies with respect to many types of risks. Our experience in this was many years ago before the introduction of the income disability and double indemnity benefits. These benefits as used today would widen further the differences in underwriting practices. There is also the fact that a plan of this kind does not encourage the Reinsurer to try to meet the Insurer's practices, since it is not sure of receiving a fair average of the Insurer's business.

A second arrangement is one where the Insuring Company gives its first excess in turn to the other companies in the group, or a pro rata of each cession to the several companies so that an equal distribution is made, the reinsurer still reserving the right to refuse any case submitted. This appears to be an improvement in one respect over the first plan, since it attempts an equal distribution, but the distribution is upset to practically the same extent by the rejections. In other respects, the same disadvantages are found. Both plans are some distance away from the question of the service needed by the Insuring Company and so fall short of satisfaction.

There is a third basis for an arrangement of this kind, in which the business is not only distributed evenly so that the cessions will represent an average of the ceding company's general business, but in addition, the cessions are automatic. This comes nearer being an ideal arrangement if it can be worked out; and I think it can. It can at least on the standard business—life portion—and I think also can for disability and double indemnity, though as to substandard business it is most difficult. It is the sort of proposition, however, which will be either a failure or a success,—depending upon the companies that enter the group, and the spirit in which they approach it; also depending upon the skill and experience of their underwriting departments, and upon the patience with which they undertake it, and the amount of money and time they are willing to put into it. To satisfactorily work out such an arrangement requires a great deal of time and leadership because to do so it is necessary to harmonize the underwriting practices of all companies concerned. To include reinsurance of disability or double indemnity introduces a problem covering as many different ideas as there are disability and double indemnity clauses in the group. To include reinsurance of substandard business necessitates treating with and harmonizing as many ideas and plans as there are men in the group. Necessarily, then, to work to a successful conclusion, to the point where the service that group is going to give its own members will meet with entire satisfaction, is a task which involves an infinite degree of patience and skill. It can not be perfected in a short time. I would not put it short of two years required to perfect a smooth, complete and satisfactory arrangement, and in most cases it will take a longer time with the attendant considerable expense of frequent joint conferences of the companies. To perfect such a plan, each company must be imbued with the idea of giving the maximum of service to each other company. All of them must be agreed, united and put in accord on virtually all underwriting practices and if the arrangement is to continue, they must be kept in that degree of accord. This requires time, effort and expense. Adding this to the ordinary administrative cost on reinsurance business, it is apparent that the service given by any one member of the group on the business it receives will measure very closely to any small margin of so-called profit there may be on that business. If such a group is formed and perfects its plans as outlined in the foregoing, it will have a service which will be found exceedingly helpful. After all, however, it seems to me to get right back to the proposition I first mentioned, which is really fundamental, viz.: that in buying reinsurance of any risk the premium paid covers mortality plus service and that we cannot get back for ourselves the portion spent for service by accepting reinsurance in exchange from the other company for the reason that the margin between premiums received and claims paid on the business so accepted is in turn spent by us in service extended.

BOOK REVIEW

Calculus and Probability for Actuarial Students. By ALFRED HENRY, F.I.A. London: Charles & Edwin Layton. 1922.

Pp. vi + 152.

The aim of this book is to supply such mathematical needs of the Actuarial Student as are not usually contained in a good textbook on Higher Algebra. The book commences with a short chapter explaining certain terms and dealing with graphical representation; this is followed by eight chapters on Finite Differences, five on Differential Calculus, one on the relation of Differential Calculus to Finite Differences, five on Integral Calculus and a chapter on Probability.

The treatment of the subjects is very practical, and a good collection of examples is provided at the end of the book, divided according to the chapters to which the examples belong.

I have noticed only two misprints, namely: on page 88 in the formula in the fifth line of paragraph 1, where $D^2/2!$ should be read for D^2; and in the last line of page 18, where the indices should be enclosed in brackets.

Chapter IX, "Finite Differences. Functions of Two Variables," develops formulae and gives illustrations of their application but, like all the papers with which I am acquainted, fails to call attention to an important practical difference between single and double interpolation. In both cases it is important to use *adjacent* values. As pointed out in paragraph 2 of page 29, formulae of Central Differences are designed to give effect to this. However, whereas in case of single interpolation there is no question as to which are adjacent values, in the case of a double entry table of a function of two variables the sets of values which are adjacent depend on the arrangement of the table. For example: if we take the arrangement of the table as represented by horizontal and vertical lines, the four adjacent values will be at the corners of the square in which the value required falls; but if the table is rearranged so that the diagonals in one direction become vertical, one of the adjacent values is changed. In Example 1 given on page 56, if in applying first difference interpolation as in paragraph 5 the value had been considered as a function of the first age and the difference of the ages, which is generally better in the case of contingent insurances, the result would have been .10765 instead of .10822 (true value .10773). As to this point a student will probably find it instructive to make a small table of values of $x^2 - 4y^2$ and to notice the two directions in which the second differences are zero; in any other direction, second differences are constant but not zero. This will suggest that in many cases the interpolation of values of a function $f(x, y)$ may be simplified by a linear transformation of the variables so that $f(x, y)$ becomes $F(u, v)$ where $x = au + bv$ and $y = cu + dv$. When the mathematical formula for the function is not known, an examination of the values in the table will suggest the transformation (which corresponds to change in the arrangement of the table) which will simplify the interpolation; sometimes general principles will suggest the transformation, for example, in case of contingent insurances, it seems reasonable that one of the equations of the transformation shall be $x - y = u$. It is not necessary for the transformation to be linear; however, it is only a linear transformation that corresponds to a simple rearrangement of the table.

With reference to the Author's introductory "Note as to Symbols," it may be of interest to point out that the first and third of these symbols are among those which, from some time in the latter half of the last century, have been recommended for use in printed matter in order to simplify the work of the compositor.

The book is recommended to students, in which term are included not only those who are preparing for examinations but all interested in the subject.

H. W. CURJEL

MINUTES OF THE MEETING OF THE AMERICAN INSTITUTE OF ACTUARIES HELD AT HOTEL CHASE, ST. LOUIS, MO.

November 2 and 3, 1922

The Institute was called to order by President Cathles at 10:30 A.M., Thursday, November 2, and the following Fellows and Associates were present:

FELLOWS

S. E. Allison
L. A. Anderson
A. E. Babbitt
W. N. Bagley
C. H. Beckett
J. P. Bowerman
W. H. Buttolph
L. M. Cathles
Arthur Coburn
R. B. Coit
H. W. Curjel
E. O. Dunlap
Jas. Fairlie
E. G. Fassel
J. E. Flanigan
George Graham
Marcus Gunn
J. C. Harvey
C. E. Herfurth
J. E. Higdon
I. S. Homans
R. G. Hunter
E. L. Marshall
F. B. Mead
W. O. Morris
J. G. Parker
G. B. Pattison
S. L. Phelps
T. A. Phillips
J. C. Rietz
J. C. Seitz
B. J. Stookey
R. M. Webb
F. S. Withington

ASSOCIATES

G. W. Bishop
L. T. Boyd
Helen L. Clark
W. P. Coler
C. R. Goodrich
J. V. Hanna
W. M. Johnson
F. R. Jordan
C. A. McConaghy
Gertrude L. Pardieck
E. A. Porter
M. R. Scott
C. O. Shepherd
R. B. Sturtevant
H. S. Wiggins
Helen J. Williams

The following Contributing Companies were also represented by other than Fellows or Associates:

American Bankers	R. A. Haun
Atlantic Life	J. W. Sinton, Jr.
Bankers Life Co., Des Moines	W. S. Ayres
Bankers Reserve Life, Omaha	G. D. Babbitt
Bank Savings Life, Topeka	Geo. L. Grogan
Canada Life	W. A. P. Wood
Cedar Rapids Life	M. L. Ridgeway
Central Life, Des Moines	O. C. Miller
Central States Life, St. Louis	A. G. Froehly G. R. Dusenbrock

Columbus Mutual Life	C. Mitcheltree
Continental Life, St. Louis	A. R. Churchman E. C. Pakes L. Marks H. O. Cedarholm
Dakota Life	J. J. Bell
Equitable Life of Iowa	H. W. Foskett
Farmers & Bankers Life	J. W. Waite
Federal Life	L. D. Cavanaugh A. R. Thompson
Franklin Life	J. A. Budinger
Great Northern Life	J. P. P. Oliver
Guaranty Life	L. J. Dougherty
International Life	G. E. Myers
Jefferson Standard Life	H. P. Leak
LaFayette Life	F. L. Alexander
Lincoln National Life	W. F. Poorman A. J. McAndless Weltha McLachlan E. L. Carvin
London Life	J. A. Campbell
Maryland Life	C. G. Smith D. H. Garver
Metropolitan Life	M. W. Torrey
Midland Life	A. B. C. Mott
Missouri State Life	Jas. Scott C. H. Helm
National Life & Accident Co.	W. H. McBride
Northwestern National Life	J. S. Hale
Ohio National Life	S. J. Blashill J. H. Evans
Old Line Life	J. E. Reilly
Peoria Life	P. F. Bourscheidt
Phoenix Mutual Life	J. R. Larus, Jr.
Provident Life & Trust Co.	M. A. Linton
Provident Life & Acc. Co.	J. D. Reeder
Reliance Life	J. N. Jamison
Reinsurance Life Co. of America	R. M. Malpas
Scranton Life	R. Merriman
Standard Life	T. C. Rafferty
Southland Life	P. N. Thevenet
Union Central	W. H. Cox G. F. Hollenberg
Western Union Life	E. M. Heath
Wisconsin Life	G. D. Adams

The President's address was delivered by President Cathles, and the minutes of the meeting held June 1 and 2, 1922, as printed in No. 23 of the RECORD, were approved.

The Secretary presented a summary of the actions of the Board since the last annual meeting of the Institute and such actions were approved and confirmed.

The Institute then proceeded to the discussion of Mr. J. C. Rietz' paper presented at the June meeting, and the informal discussion of topics on the program. The morning session was adjourned at 12:00 noon.

The Institute re-convened at 2:00 P.M. and continued the informal discussion and the afternoon session was adjourned at 5:00 P.M.

The Institute re-convened at 9:30 A.M., Friday, November 3d, and continued the discussion of informal topics, and the morning session was adjourned at 12:00 noon.

The afternoon session convened at 2:00 P.M. and the discussion of informal topics was concluded. The meeting adjourned at 5:00 P.M.

G. B. Pattison,
Secretary.

HG
8754
A657
v. 11

American Institute of
Actuaries
Record

PLEASE DO NOT REMOVE
CARDS OR SLIPS FROM THIS POCKET

UNIVERSITY OF TORONTO LIBRARY